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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Lobby and Leak

TO a technical journal such as our own there is nothing more exasperating than to hear information of significant professional interest publicly blabbed by politician or smart-alec observers of the scene in flagrant contempt of security regulations. True, those same regulations are only too often provocative of fury in themselves; but their unilateral violation, or expedient disregard, is more frequently anti-social or unpatriotic in origin than it is morally justifiable.

We are reminded of this sorry state of affairs by a comment made by Frank Beswick in his report on the Blue Streak debate (page 617). Though it is not possible, he points out, to legislate against gossiping and lobbying at cocktail parties, it is surely undesirable that responsible parliamentary spokesmen should have to rely heavily upon information gleaned on such occasions. There is always the tendency, Mr Beswick observes, for those whose opinions are not accepted, or whose products are not being sold, to lobby the most vigorously; and, apart from any question of ethics, a balanced judgment is more difficult to reach when the discontented have had the biggest say. Those MPs who have been asking for some form of Commons Defence Committee, on American lines, by which means Ministers and departmental heads could be questioned in a rational manner, have surely had their case strengthened by the recent debate.

A more sinister sort of chicanery than the lobby is the leak. Defence regulations should remain as inviolable as Magna Carta; yet the practice of leaking supposedly confidential information for commercial or political advantage may be passing uncensured.

Untidiness in matters of national security is undesirable. Messiness would be unpardonable.

Questions of Airworthiness

THE airworthiness standards of transport aircraft should, we feel, be agreed by a single world authority. This is not such an unattainable ideal: the International Civil Aviation Organization now recommends a code which, so far as it goes, has been universally agreed. And the codes of the two major airliner-manufacturing nations, the US and the UK, are closer than they have ever been before—after many years of patient give-and-take on both sides. We believe that British influence has been considerable in this field; a topical example is the BOAC Boeing 707 modification programme called for by the Air Registration Board, to whose chief test pilot particular credit must go.

But it is odd that in this country the Air Registration Board clears transport aeroplanes for civil users only (a special exception being the Comet 2s of RAF Transport Command, which were required to have civil certificates). What happens when the same type of transport aircraft—e.g., Britannia and Argosy—is ordered for the RAF as well as by civil operators? The answer is that the Air Ministry and the Ministry of Aviation weigh in with what amount to their own standards.

These Ministries must of course have their say in the acceptance of combat aircraft. But when we have an ARB to assess the airworthiness of transport aeroplanes, is it not a waste of taxpayers' money for Ministries to duplicate the job? The RAF must, again, have its special user requirements; but, so far as airworthiness and inspection requirements are concerned, why cannot the ARB code suffice?

FROM ALL QUARTERS

PRESIDENT of the Royal Aeronautical Society for 1960-61 is Dr E. S. Moult who, as recorded on page 615, was being inducted this week. Technical director of the de Havilland Engine Co since 1957, he joined DH in 1941; previously he had been associated with Maj F. B. Halford in the design of many famous engines

Whirlwind Mk 10s for the RAF

WHAT is described as "a substantial order" for the Westland Whirlwind Mk 10 helicopter has been placed by the Ministry of Aviation on behalf of the RAF. This new Whirlwind is powered by a single D.H. Gnome turboshaft engine of 1,000 s.h.p. It was announced on April 20 (*Flight* last week) that the D.H. Engine Co had had an initial MoA contract for "a large number" of Gnomes for Whirlwind Mk 10s and for re-engining existing Whirlwinds. A Whirlwind experimentally powered by a Gnome turbine unit first flew about a year ago and since then considerable flight development work has taken place. The Gnome, described in our issue last week, is mounted horizontally in the Whirlwind.

BAC Resources

CAPITAL for the British Aircraft Corporation, the new Vickers/English Electric/Bristol group, will be £20m. The corporation has been formed, in the first place, as a Vickers subsidiary; and in seeking official approval from holders of Vickers unsecured loan stock, the company says it plans to transfer assets—mainly fixed assets worth £8m—to the new organization and will take up eight million £1 shares as its 40 per cent holding in the group.

Vickers have pointed out that carrying out a merger by selling the relevant assets of Vickers-Armstrongs (Aircraft) to the BAC would have involved the company in very large obligations for income tax, stamp duty and capital duty. The Vickers board says that the amalgamation will result in overall strengthening of the financial position of the Vickers group.

German Interest in AW.660

AFTER inspecting the Argosy at Hanover last week, Herr Strauss, the German Defence Minister, asked to be kept personally informed on progress with the Armstrong Whitworth AW.660 military freighter. The German Government has expressed interest in the AW.660 with shorter take-off and landing performance, and C. S. Emery, AWA sales director, has stated that "this is a line of development in which we have been active."

Time-expiring Comets

THE calculated safe fatigue life of RAF Transport Command's fleet of Comet 2s has led to a review of the flight history of these aircraft and of several other early Comet aircraft owned by the RAF and the Ministry of Aviation.

It will be recalled that the RAF's Comet 2s were originally destined for BOAC, being well advanced on the Hatfield production line when the Comet 1 disasters occurred. Primary modifications were the insertion of redesigned cabin windows and heavier-gauge skin in the higher-stressed portions of the pressure cabin. Modifications were made also to the wing to extend its fatigue life, tests having shown this to be desirable. The RAF's Comet 2s were certificated by the civil airworthiness authorities, and the ARB issued a C of A, complete with the usual flight manual, the only unusual feature of which was that it suggested operating limitations aimed at giving the longest fatigue life.

This life was originally set at 5,000hr; subsequently, in the light of further de Havilland structural tests, life was increased to 8,000hr. An important condition was that flight recorders should be installed to permit an analysis to be made by the RAE of the operational histories of each aircraft. This is now being done.

Some RAF Comet 2s have now flown nearly 4,000hr. Though this is considerably below the conservative 8,000hr life specified, there are other factors to be taken into account. For example, any evidence of corrosion may affect the life of the structure. (Corrosion, it should be pointed out, is not a recent "scare"; the RAF have been keeping a close check on it for three years.) Again, analysis of flight histories from recorder data has shown that each aircraft has a very different history: average flight-times are as low as 1½hr on aircraft that have been used, say, for more training than others. Because one of the assumptions upon which the 8,000hr life was based was a 3hr average flight it can be seen that the 8,000hr life, conservative though it may be, may have to be reduced in the case of certain aircraft.

It is too early yet to say whether the analysis which is now being undertaken will require any RAF Comet 2s to be withdrawn from service, to be extensively renovated, or operated in a more strictly limited manner. But the time is now drawing near anyway when a firm decision must be made about the RAF's next jet transport. It seems certain that the Comet 2s, which have given such fine service (and which have been so competently operated) will become time-expired before the VC10 is available. Recent reports that ten Comet 4Cs are likely soon to be ordered for the RAF may therefore be in the "no smoke without fire" category.

Hawker Board Appointment

A NEW appointment to the board of Hawker Aircraft Ltd has been announced. Robert L. Lickley, BSc, DIC, MIMechE, FRAeS, is to join it from May 16. Formerly managing director of Fairey Aviation Ltd, he resigned that post last month when the company was absorbed into the Westland Group.

Mr Lickley joined Fairey Aviation in 1951 as chief engineer, later being appointed technical director before becoming managing director. Among the aircraft for which he was responsible were the Fairey Delta 2 and the Rotodyne. He was awarded the RAeS gold medal for aeronautics in 1957 and the Society's Taylor gold medal in 1958. His principal duties with Hawker will be assisting the managing director, J. T. Lidbury, and the chief engineer, Sir Sydney Camm, whose current concern is the VTOL fighter project, the P.1127.

Anglo-European Turbojets

ON May 2 Bristol Siddeley Engines announced an agreement with Piaggio & C of Genoa for the manufacture and sale in Italy of the Viper 11. Rated at 2,500lb, this engine will be used in the production Macchi MB.326 primary trainers for the Italian Air Force. On April 30 the West German Federation of Aviation Industries announced that Maschinenfabrik Augsburg-Nurnberg have concluded a ten-year agreement with Rolls-Royce for the joint development of "modern jet engines." The first joint product would be a turbojet of about 2,000lb thrust (doubtless one of the RB.108/145/153 family) for the West German Defence Ministry.

Helicopter Fire Rescue

A CRASHED and burning aircraft; a helicopter subduing the flames by the downwash of its rotor-blades, so that rescue operations could be effected: such was the scene (happily only simulated) at Luton Airport last Friday, when the Hunting Group and Helicopter Services Ltd staged a demonstration of this technique.

Controlled by the group fire officer, V. Cable, and with a Hiller 12C neatly flown by Anthony Lister, it showed how effective the method could be provided a helicopter is available to swing into operation. From take-off by the airfield control-tower to landing at Luton and Dunstable Hospital, this rescue took 5min 20sec, compiled as follows: 45sec for the Hiller to reach and settle by the burning aircraft; 35sec for 3rd Officer R. P. Peterson

INTEGRATION: Hawker Siddeley directors seen across an NA.39 wing with Blackburn chiefs during a visit to Brough last week. L to r: J. A. R. Kay (HS), Sir Roy Dobson (HS), N. E. Rowe, T. Bancroft, Arthur Jopling, Capt E. D. G. Lewin, J. White, Sir Thomas Sopwith (HS)

INTRODUCTION: first photograph to be published of the new Elliotts 15-metre sailplane, which is to be flown—but not by Britain—in the standard class of the World Gliding Championships next month (news item on page 624). A gliding angle of 1 in 32 at 42kt is claimed

"Flight" photograph

***SHOWN IN LONDON** at a Westland anniversary party last week was this model of the Wessex 2, powered with two de Havilland Gnomes for improved "hot and high" performance. Note baggage containers—primarily for civil use*

(wearing Siebe, Gorman Fearnought protective clothing) and Fireman T. P. Clarke to extricate the dummy pilot and get him into the helicopter; and four minutes for the flight to the hospital—a direct distance of some five miles.

There was quite a stiff breeze blowing on Luton's exposed hill-top at the time of the demonstration, tending to flatten the flames, but this did not detract from the effectiveness of the technique (already practised in the United States) or from the commendable demonstration. The managing director of Hunting Aircraft, W. A. Summers, has a personal interest in fire-rescue as president of the South Midlands district of the British Fire Services Association; and the Luton example is one that deserves to be widely followed.

Fifty Years On

GUEST of honour at a Royal Aero Club dinner on April 26 was Sir Thomas Sopwith, the occasion celebrating the 50th anniversary year of his obtaining a Club certificate. On the menu were the names of seven other surviving members of this pioneer coterie who first flew powered aircraft in 1910, the full list of people and places being as follows: Certificate No 1, Lord Brabazon of Tara, Shellbeach, March 8; No 7, A. Ogilvie, Camber, May 24; No 22, E. Keith Davies, Brooklands, October 11; No 24, J. G. Weir, Hendon, November 8; No 26, C. H. Gresswell, Brooklands, November 15; No 30, H. Barber, Hendon, November 22; No 31, Sir Thomas Sopwith, Brooklands, November 22; No. 36, A. G. Board, Hendon, November 29.

All except Messrs Ogilvie, Gresswell and Barber were present at the dinner. The holder of Certificate No 1 introduced the guest of honour with a typically Brabazonian speech, and Sir Thomas entertained the company with anecdotes of those far-off days; the three other old-timers also contributed recollections.

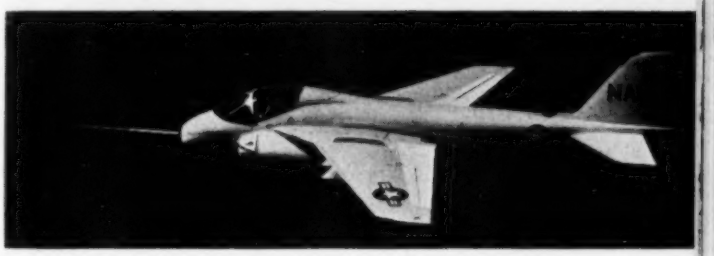
RAeS President and Awards

AT yesterday's (May 5) annual general meeting of the Royal Aeronautical Society the new president, Dr E. S. Moult, CBE, BSC(Eng), FRAeS, MIMechE, was being inducted by his predecessor, Peter G. Masefield. Prior to this ceremony, Mr Masefield (who remains on the council of the Society) was presenting awards given annually for the best papers published by the RAeS. These were as follows:—

Simms Gold Medal to D. J. Farrar, OBE, MA, FRAeS, Chief Designer (Guided Weapons), Bristol Aircraft Ltd, for his paper *The Bloodhound*. **George Taylor (of Australia) Gold Medal** to R. Hafner, FRAeS, Special Director (Bristol), Westland Aircraft Ltd and formerly Chief Designer (Helicopters), Bristol Aircraft Ltd, for his paper *Safe Mechanisms*. **Edward Busk Memorial Prize** to E. C. Maskell, MA, AFRAeS, and to Dr J. Weber, AFRAeS, both of the Aerodynamics Department, RAE, for their paper *On the Aerodynamic Design of Slender Wings*.

Orville Wright Prize to R. Hicks, PhD, MSc, G. E. C. Simon-Carves Atomic Energy Group for his papers *Asymmetrically Plate-Reinforced Circular Hole in a Uniformly End-Loaded Flat Plate* and *Symmetrically Loaded Circular Plates under the Combined Action of Lateral and End Loading*. **Herbert Ackroyd Stuart Memorial Prize** to P. Lloyd, CBE, MA, FRAeS, Deputy Director, NGTE, for his paper *Some Aspects of Engine Noise*. **J. E. Hodgson Prize** to Prof A. R. Collar, MA, DSc, FRAeS, FIAS, Sir George White Professor of Aeronautical Engineering, University of Bristol, for his paper *Aeroelasticity—Retrospect and Prospect*.

Branch Prize to Prof A. W. Morley, MSc, PhD, Whitsch, ACGI, FRAeS, Professor of Applied Mechanics, Royal Naval College, Greenwich, for his paper *Notes on Air Breathing Engines for Supersonic Flight*. **Navigation Prize** to E. G. C. Burt, Guided Weapons Department, RAE, for his paper *Theoretical Principles of Guided Missile Systems*. **Usborne Memorial Prize** to D. G. Drake, BSc, GradRAeS, Department of Applied Mathematics, University of Liverpool, for his paper *Quasi-Steady Derivatives for the Subsonic Flow Past an Oscillating Aerofoil in a Porous Wind Tunnel*. **Pilcher Memorial Prize** to C. L. Bore, BSc(Eng), GradRAeS, Project Office, Hawker Aircraft Ltd, for his paper *Some Practical Aspects of Kinetic Heating Calculations*.



***GRUMMAN A2F-1 INTRUDER** is the full title of this new US Navy aircraft—counterpart of the Blackburn NA.39. Designed for all-weather attack, it employs the DIANE digital integral attack navigation system and has jet deflection for the two Pratt & Whitney J52-P-6s*

Maurice Imray Leaves RAeC

A LEADING figure on the British sporting-flying scene for many years, Maurice O. Imray has resigned as aviation secretary of the Royal Aero Club to become manager of London Aero Club, Panshanger. He will be concerned with development of Panshanger as a business-flying centre, and with the reopening of London Aeroplane Club to provide flying training for businessmen. London Aero Club, formed by W. Nat Somers, is the holding company responsible for both the aerodrome and the operating club.

Mr Imray founded the Ultra Light Aircraft Association in 1946, and became secretary to its successor, the Popular Flying Association, in 1951, continuing in an honorary capacity from 1952 to 1958. In 1953 he joined the air touring department of the RAeC and was manager of this department from 1954 until his appointment as aviation secretary in 1957. He is succeeded in this post by R. R. Stephenson.

IN BRIEF

Nimbus has been approved by the MoA as the name for the Blackburn A.129 engine ordered for a pre-production batch of Saunders-Roe Wasp helicopters for development for the Army.

Sir Thomas Sopwith is to give an inaugural lecture to the Historical Group of the Royal Aeronautical Society on May 17, starting at 6 p.m., at the Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1. He will talk about his first ten years in aviation.

Lester Brain has resigned as managing director of de Havilland Aircraft Pty Ltd, Bankstown, Sydney; he has been with the company since 1955, when he left TAA. The DH chairman, A. Murray Jones, has announced board changes. Maj Hereward de Havilland, who recently retired to live in Australia, becomes a director and is acting as deputy chairman; and D. H. McLachlan, general manager, becomes finance director.

R. A. V. Hazlehurst, a Bristol Siddeley Engines test pilot, and two of the company's flight development technicians, P. Field and E. P. Potter, lost their lives last week in an accident at Filton to a Fairey Gannet. Mr Hazlehurst, who flew with Bomber Command during the war and won the DFC, joined Bristol Siddeley in March last year and had some 7,800 flying hours on 30 different types of aircraft.

The flight-test programme of the Avian 2/180 gyroplane has been set back by about six months following an accident on April 8 in which extensive damage occurred to the prototype. The company state that the programme was "sufficiently advanced to establish much of the predicted data and show that the gyroplane is airworthy" and that arrangements are in hand to re-finance Avian Industries Ltd so that another prototype may be built. Work has already begun.

The second Avro Vulcan prototype, VX777, made its last flight on April 27—to RAE Farnborough, where it will be used for ground tests. It first flew on September 3, 1953, and was later modified to become the aerodynamic prototype B.2, first flying as such on August 31, 1957.

The Fairey Co Ltd have announced that in consequence of the sale of their subsidiary Fairey Aviation to Westland Aircraft, the address of the Fairey Co is now Woodlands Park, Iver Heath, Bucks. The company's London office is still at 24 Bruton Street, W1 (tel. MAYfair 8791).

Harold F. Pitcairn, president of the Autogiro Co of America, was found dead at his Philadelphia home on April 23. He was awarded the Collier Trophy, with his associates, for the "greatest achievement in aeronautics" in 1930: and in 1931 received the John Scott Medal jointly with Juan de la Cierva. He was 69.

A "Save the Sunderland" meeting is being held at the Imperial War Museum, Lambeth Road, London SE1, at 3 p.m. next Sunday (May 8). One proposal to be discussed is the purchase of a Sunderland from the Naval department of the French Ministry of Defence, at a cost of about £6,000. This would be only half as expensive as the original plan to purchase and fly home a New Zealand Sunderland.

One of the exhibits at the Mechanical Handling Exhibition, which opened on Tuesday at Earls Court with some 300 firms represented, is an English Electric Thunderbird, shown on a "Kestrel" side-operating fork-lift carrier. The exhibition is open (except Sunday) from 10 a.m. to 6 p.m. until May 13. Admission is by trade invitation or by payment of 2s 6d at the doors.

The Edo 345A Loran receiver installed between the pilots' seats of Edo's own Cessna 310. Further details below

FLIGHT SYSTEM SURVEY

Reconnaissance Radar

THE US Army Combat Surveillance Agency recently announced the development, by the Army Signal Corps, of a new high-definition reconnaissance radar capable of producing better pictures than a conventional camera at long range and regardless of weather. It could be used to watch enemy territory from an aircraft flying over friendly country. The equipment, which incorporates a special new aerial system, can be installed in small aircraft such as those already operated by the US Army.

Air Traffic Computer

FORMING the core of the data processing central for the new US Federal Airways system, a special computer has now been installed for initial trials at the FAA experimental centre at Atlantic City. Designed and built by the Librascope division of General Precision Equipment Corporation, the computer will provide a complete data-handling system capable of processing and printing 1,600 flight progress strips per hour and processing 400 aircraft flight plans an hour. It can store 1,000 different flight plans and sequence the arrival, or monitor the departure, of 90 aircraft per hour.

Bendix Integrated Instruments

BELOW is a photograph, taken at the Hanover Air Show, of the new Bendix integrated flight instruments, the vertical linear units of which form part of the new USAF standard instrument panel. Attitude and course dials for this panel are provided by Lear. Those shown here are the new Bendix 300 series flight directors. All these units rely on remote sensing and computing devices and some form of stand-by instruments are therefore normally added to such a panel.

The attitude instrument has a black and white ball to show aircraft attitude against the fixed aircraft silhouette. The second silhouette above the horizon in this picture is the attitude director, which may be coupled to ILS and VOR computers. The course display shows VOR/ILS cross-pointers related to a moving compass card, but the pointers may be manually rotated into the vertical position if the compass component fails.

The left-hand vertical scale has g, Mach number and airspeed scales, the actual values for each quantity being read against a fixed lubber-line half-way up the scale. Demanded values may be set with the slewing switches and counters beneath the tapes to position command index lines on the scales. On the right are similar scales for vertical speed, height and cabin and target height, the last-named set either on verbal instructions from the ground or automatically by a data link. All the lubber-lines, on a single level passing through level-flight position of the artificial horizon, provide a horizontal reference for all quantities controlled by fore-and-aft movement of the control column. Heading indications appear along a central vertical axis.

It is noteworthy that the RAF has abandoned tape indication for height and vertical speed because of the difficulties of tape scaling and because the rotating needle gives a better appreciated indication of height displacement. The Americans say that the use of command indices restores this visual scale effect to make the tape as readily noticed out of the corner of the eye as a moving needle on a dial.

The Bendix vertical scale instruments incorporated in the new USAF standard instrument panel and the attitude and course dials of the new 300 series civil integrated instrument system. This picture was taken at the Hanover Air Show last week

Loran for Small Aircraft

LONG established as a primary long-range navigation aid for large aircraft, Loran can now be fitted in quite small ones. The model 345A receiver produced by the Edo Corporation has a 3in scope, which can be mounted in an instrument panel, and a 6in×4in control panel on which position-lines can be directly read. Indicator and controls and the ¼ATR case together weigh 31lb; and dual control heads can be fitted to allow simultaneous reading of two position-lines.

The 345A, which costs $4,900 (about £1,750) is used by many airlines and the USAF Military Air Transport Service. It is now also being fitted in an increasing number of business aircraft, including a Viscount owned by an American company and a Gulfstream operated in Canada. The picture at the head of this page shows the equipment installed in Edo's own Cessna 310.

Narco Expansion

THE National Aeronautical Corporation, more usually known as Narco, is well known as a producer of a wide range of light aircraft radio and navigation equipment, and its products are becoming increasingly familiar in Britain as more and more American aircraft are imported. Not many Narco units are yet officially approved for operational use here, although their installation is permitted.

Most recent units are an 18oz marker receiver, the Mk V communications unit with 90 transmitting and 190 receiving channels, and the Mk VI crystal-controlled receiver with VOR/localizer unit. The company is now making prototypes of a DMET receiver for light aircraft and expects to sell between $30m and $40m worth by 1965. A new simplified ADF is also being designed and certain other equipment should be announced soon.

The American boom in both business aircraft and radio equipment for them has launched Narco on a considerable expansion. Sales were 41% higher during the 1959 financial than in the previous year and manufacturing and design-office space have respectively doubled and quadrupled.

United Kingdom distributors for Narco are Vigors Aviation at Kidlington. This company also handles A.R.C., Dare and Collins.

E.M.I. and Fairbanks Whitney

AN agreement has been concluded between E.M.I. Electronics Ltd and the Fairbanks Whitney Corp of New York under which E.M.I. computers and electronic production and control equipment will be marketed and, in some cases produced, in the US. In addition, E.M.I. will also sell certain of the American manufacturer's equipment in Europe and both companies are studying the possibility of a joint venture in the electronics field in the European Common Market.

Missiles and Spaceflight

THE BLUE STREAK DEBATE

THE Opposition motion of censure on the Government debated on Wednesday April 27 was phrased as follows: *That this house deplores the refusal of the Government to establish a committee of inquiry into the circumstances surrounding the initiation, continuance and cancellation of the Blue Streak missile, which has involved the expenditure of a large amount of public money on a project long believed and now officially declared to be of no military value.* Among the more important parts of the speech made by Harold Watkinson, Minister of Defence, during the debate were the following passages:—

"Allegations that this project was carried on to a point where money was wasted on it must imply that it was carried on in the face of scientific, technical and military advice that it should be stopped. Such advice was not tendered to me in November last year, as it was not tendered to my right hon Friend (Duncan Sandys) before this time. . . . Of course, the decision was a narrowly balanced one. All big decisions are. . . .

"The V-bombers, with the Blue Steel flying bomb—that is to say the bomb now being fitted—will meet our full contribution to the West's nuclear deterrent until the mid-1960s. In other words, we do not need to add to our major commitment here over this period even if the means were available. After the mid-1960s, which is when Blue Streak was planned to become available, we are now able to choose what type of missile we shall adopt, on the principle that we shall provide our own warhead and our own mobile launching platform by sea or air. . . .

"After the Blue Steel bomb, which is now our current nuclear carrier, faded-out in the mid-1960s, we were going to go ahead with a second mark of that weapon. The fact is that the second mark has now become too vulnerable as a surface-to-air guided missile. Sky Bolt is the perfect and almost invulnerable replacement for it. . . .

"We have had people integrated in the Sky Bolt team for a considerable period. Therefore we have kept a close watch on its progress. The initial specification drawn up by the United States authorities included the requirement that Sky Bolt should be capable of being carried in the Mk 2 V-bombers as well as in the B-52. In other words, the V-bombers have been in this programme from the beginning.

"Two British teams are at present in the United States studying the detailed problems involved in the installation of the missile in our aircraft. The United States government have just sent a team over here to explain to us at first-hand the operational and technical aspects of the Sky Bolt programme as it stands now. It was their reassuring report, coupled with the fact that the United States government had put a very large sum of money into this weapon's development, which certainly assisted me in coming to the decision which I did.

"Lastly, the United States government have taken a firm decision to press on with the development of Sky Bolt with the highest priority. A programme for the progressive fitment of this missile to the Mk 2 V-bombers is being worked out. Wind tunnel trials are going on, and it will shortly be necessary to have closer contact and, in due course, to send production Mk 2 V-bombers for flying trials in the United States. This does not mean that we shall not go on with our consideration of the submarine-launched Polaris missile. I have asked the Admiralty to put in hand an urgent study of the requirements for British-built submarines capable of carrying the Polaris-type missile."

A Comment on the Debate

One of *Flight's* representatives present at the debate was Frank Beswick, who has contributed the following general commentary.

The Commons' inquest on Blue Streak [he writes] produced one of the most remarkable defence debates in recent times. There was a freshness and spontaneity about it that is often missing in the staged debates on the annual White Papers. Of the five ex-Ministers who spoke from the back benches, three from the Government side, not one was content simply to toe the party line. Although George Brown called the Blue Streak project the "personal cross" of Mr Sandys, it was everywhere realized that issues much wider and deeper than any personal responsibility were involved.

One such issue was undoubtedly that of parliamentary procedure itself. No one can claim that the present system of discussing defence matters enables Parliament to be adequately informed on the matters which, nominally, they decide.

One of Mr Brown's charges, of course, was that the Government collectively, and Mr Sandys personally, had persisted in spending money on Blue Streak long after expert technical opinion had turned against it. The charge was pressed in these very interesting terms: "I am not at liberty to quote those who advise me. The House must accept it from me that all through that year (i.e., 1958) I was receiving lots and lots of advice from people who it was inconceivable to believe were not also talking to the Minister. . . . There was virtually nobody in the Service Departments at that time who was not taking the trouble to tell anybody about it who would listen. I have minuted notes of receptions and of conversations in which leading Service men made only the reservation, 'Do not quote me.' They took no trouble to avoid being seen talking to me and urging this policy upon me."

Though gossiping and lobbying at cocktail parties cannot, of course, be legislated against, it is surely undesirable that responsible parliamentary spokesmen should have to rely so heavily upon information gleaned that way. For one thing there is always the tendency for those whose opinions are not accepted, or whose products are not sold, to lobby the most vigorously. Apart from any question of the ethics of the matter, a balanced judgment is more difficult to reach when the discontented have had the biggest say. Those Members who have been asking for some form of Commons Defence Committee, on American lines, at which Ministers and departmental heads can be questioned in a rational manner, will have their case strengthened by this recent debate.

Long-term Continuity

There is another aspect of this matter of informing Parliament which was quietly but most impressively made by Aubrey Jones. He put it this way: "A project such as Blue Streak lasts the greater part of ten years. Any significant technological project these days lasts the greater part of ten years. In the course of ten years we in this country are likely to have three administrations. Within those administrations we have many Ministers, each Minister bringing to the project, and being expected by public opinion and by the Press to bring to the project, a new look."

In these circumstances, as Mr Jones went on to say, some element of continuity there must be if anything is ever to be produced. But to get that continuity there must obviously be a wide and genuine acceptance of any prime decision—and an acceptance based upon fairly full information.

Mr Jones proved to be the only speaker who had doubts about the wisdom of stopping Blue Streak. He recalled the great argument of 1957 between the manned aircraft and the missile. The present Minister of Aviation, then Minister of Defence, decided to cancel the supersonic bomber and to retain Blue Streak. "In my judgment," said the former Minister of Supply, "that decision was right for the reason that, important as mobility was, Blue Streak opened up an entirely new field of technology far transcending in importance the purely military application, a field likely in the course of time to be important civilly as well as militarily. By mastering the technology of this rocket, this country in the course of time would make a contribution befitting its talents in an entirely new sphere. That was the real case for the decision taken in 1957, and in my judgment that case is every bit as valid today as it was three years ago."

Mr Jones was very sceptical of both Sky Bolt and Polaris. Neither, he claimed, had the same significant potential for civil application. And then, unperturbed by the hostile glances on the government Front Bench below him, Mr Jones went on to make other criticisms of the defence supply arrangements with which he had so recently been associated. We were unwarrantably maintaining two surface-to-air guided weapons (the Army and the Air Force having "failed to reconcile their requirements"): and the 45-ton tank, the Lightning intercepter and the TSR.2 aircraft were all developed to specifications so peculiar to ourselves that they were unlikely to command a sale abroad. And, in the missile age, we still maintain a sizeable Fighter Command. Having tolerated this expenditure we now cavil, complained Mr Jones, at an annual expenditure on rocket development which was 50 per cent less than the annual cost of subsidizing egg production.

Sir Arthur Harvey was a good deal more enthusiastic about Sky Bolt than other back-bench speakers. He said, "I was talking to one of the most eminent men in the British aircraft industry . . . technically minded . . . good commercial outlook . . . made a great contribution to the industry . . . just returned from the United States and is very optimistic about Sky Bolt . . . he thought there was a reasonable chance of it being delivered in three years." Sir Arthur went on to ask the Minister to make up his mind quickly whether the VC10 or the Super VC10 would be required as a carrier for Sky Bolt.

But from other speakers, on both sides of the House, there were earnest pleas that we should make up our minds on issues more fundamental than that of aircraft and missile types. "We

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cannot have a change of this magnitude," warned Mr Brown, "and imagine that basic policy can remain the same as though nothing has happened." Mr Brown did not go on to specify what changes he had in mind, but it is reasonably certain that from Labour spokesmen in the future we shall not be hearing very much more about an independent nuclear deterrent for Britain.

From the Government side, and from his position as the previous Minister of Defence, Antony Head again unfolded his anxieties to the House. "I fear that Western defence policy today is veering more and more towards undue reliance on atomic weapons. . . . Undue dependence on atomic weapons means that something which is not a mortal threat, but a very serious threat, will result in inaction unless we have adequate mobile and well-equipped conventional forces."

Though his best friends could scarcely tell Mr Sandys that his parliamentary performance on this occasion ranked among his best, he did answer adequately the narrower question on which the debate had been based. If Blue Streak was to be cancelled then the decision could not have been made before even the USAF had adopted Sky Bolt—if that is to be Blue Streak's successor. But what are the terms and what will be the cost? How independent shall we be? What will be left of the national housekeeping money for the development of aircraft? What is the prospect for a heavy supersonic aircraft? Is this to be part of a bargain with the USA? And how serious will now be the British participation in rocketry? "One of the saddest spectacles on the British scene at the moment," said Aubrey Jones, "is the Minister for Science, aware of the problem, given an impossible mandate, and patently at his wits end to know what to do about it." Is it really the case that serious development of rocketry is impossible in this country unless it is tied to a military project?

EIGHTFOLD SATURN TEST

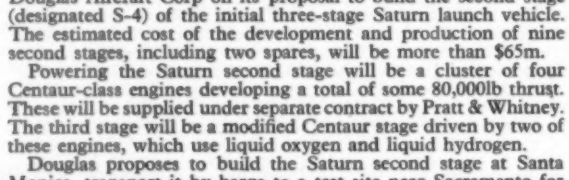
The first simultaneous testing of all eight Rocketdyne H-1 engines of the Saturn space booster took place at Huntsville, Alabama, on April 29, and was described by a NASA spokesman as a complete success. A thrust of approximately 1.3 million pounds—a record figure for a Western-world booster—was developed for a period of less than ten seconds.

SATURN SECOND-STAGE NEGOTIATIONS

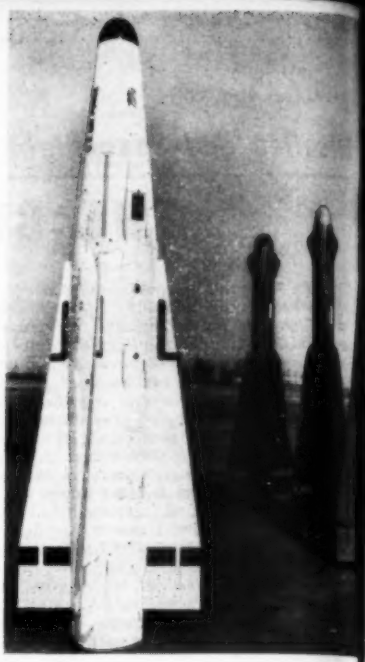
On April 26 the National Aeronautics and Space Administration announced that it would begin negotiations "immediately" with Douglas Aircraft Corp on its proposal to build the second stage (designated S-4) of the initial three-stage Saturn launch vehicle. The estimated cost of the development and production of nine second stages, including two spares, will be more than $65m.

Powering the Saturn second stage will be a cluster of four Centaur-class engines developing a total of some 80,000lb thrust. These will be supplied under separate contract by Pratt & Whitney. The third stage will be a modified Centaur stage driven by two of these engines, which use liquid oxygen and liquid hydrogen.

Douglas proposes to build the Saturn second stage at Santa Monica, transport it by barge to a test site near Sacramento for static test-firing, and then ship it eastwards through the Panama Canal. The first of the S-4 stages will be freighted by barge to NASA's Marshall Space Flight Center at Huntsville for checkout and mating with the eight-engine first stage, and both stages will then be shipped by water to Cape Canaveral.



Clues to the Seacat guidance system are contained in this "exploded" drawing, just cleared for publication. Last week it was announced that Focke-Wulf have agreed to support the Short & Harland missile during an evaluation by the West German Defence Ministry



As noted below the most potent member of the Falcon family of air-to-air missiles is the GAR-11 (left). In the background are, from left, GAR-1D, GAR-2A and GAR-3. Data for these earlier Falcons were given on page 531 of our November 6, 1959, issue; GAR-11 is 7ft long, has a diameter of 11in and weighs just over 200lb

NUCLEAR FALCON

Towards the end of last month the US Air Force released the first photographs of GAR-11, their first nuclear air-to-air guided missile to go into production. As the photograph shows, it retains the same aerodynamic configuration as its predecessors, but is much fatter and weighs almost twice as much. Curiously, the example shown has the blunt radome of the original GAR-1, whereas the pointed dielectric moulding carried by GAR-3 confers lower supersonic drag. It may well be that the operational version may be slightly different from the GAR-11 illustrated.

Compared with earlier members of the Falcon family GAR-11 is only an inch or two longer. The body is divided into four major portions, which are bolted together before delivery to a field unit. Doubtless magnesium alloys and reinforced plastics are extensively employed, as in earlier Falcons. The foremost 3ft are occupied by the radar guidance system (one assumes that there will also be an IR-homing model). Then, at the point of maximum diameter, the nuclear warhead is installed, together with its complex arming and fuzing systems. Ahead of each of the four wings appear to be a flush strip aerial, not present in earlier Falcons, and between one pair of wings are arranged three pairs of axial projections which presumably form the zero-length mounting.

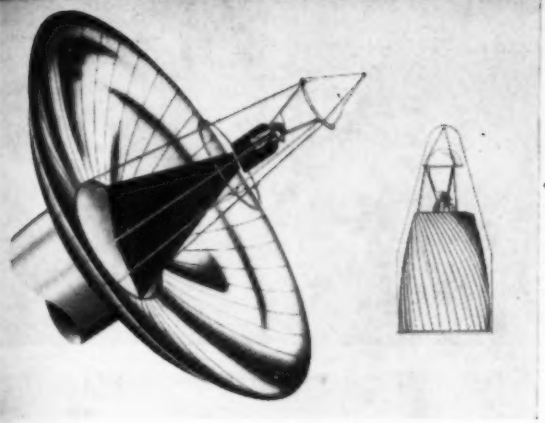
Although supersonic drag is probably up by at least 50 per cent compared with that of previous models, the greatly increased cross-section of the body should enable the total impulse of the motor to be approximately double, and the range of GAR-11 may be in no way inferior. The new missile will be carried by the Convair F-102 and F-106, and should with little difficulty be accommodated by the Northrop F-89J and McDonnell F-101B. Deliveries from Hughes Aircraft at Tucson, Arizona, are now being made to Air Defense Command to supplement the earlier Falcons with conventional warheads and the Douglas-built MB-1 Genie (which, although nuclear, has no guidance system).

A more advanced Falcon, with much greater range, is the GAR-9. This missile was being developed, together with the ASG-18 fire-control, for the F-108 Rapier; and when this aeroplane was cancelled last September the GAR-9 was continued but at a reduced tempo. In addition, a guided version of Genie is unofficially said to be under development; and, for the US Navy, Bendix are prime contractor for AAM-N-10 Eagle, the largest air-to-air missile in the world, with a range of the order of 100 miles.

PLANS FOR AGENA

The National Aeronautics and Space Administration is to buy 16 Agena-B vehicles from Lockheed Aircraft Corp, to be delivered over the next three years at a cost of approximately $50m. The Agena units will be used as second stages together with either Thor or Atlas. The former combination will place 1,500lb in orbit around the Earth, while the Atlas-Agena-B will be capable of placing either 500lb in a 300-mile Earth orbit, or 800lb on a "deep space" mission.

The first NASA Atlas-Agena-B launches, in mid-1961, will be directed mainly towards lunar investigations. Beginning in late 1961, Thor-Agena-B vehicles will be used for a number of Earth satellites including Nimbus meteorological satellites planned to succeed the Tiros series. The Atlas-Agena-B series replaces the Vega programme which the space administration cancelled last December.



Negotiations began last month between NASA and the Topco Group of Thompson Ramo Wooldridge for the development of this solar auxiliary power system for spacecraft. The 32ft parabolic petal-type solar collector is shown folded (right) to fit in the nose fairing of a launch vehicle such as Centaur or Saturn. The device, which is designated Sunflower 1, should weigh some 700lb and generate 2kW for approximately one year

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SPACE VEHICLES DISCUSSED

A varied selection of papers was presented at a conference on the structural design of space vehicles organized by the American Rocket Society in Santa Barbara, California, last month. These included the three papers, summarized below, presented by representatives of the Rand Corporation, Douglas and Chance Vought.

Much had already been said and written about the problems of getting to the planet Mars, but it remained for Francis T. Cartaino (Rand) in his treatise *Vehicles for the Exploration of Mars* to discuss what one did after arrival there. Early martian explorations would undoubtedly be conducted on foot, but it would ultimately be desirable to move about by mechanical means. A family of Mars exploratory vehicles included the following types: ambulatory, surface, helicopter and aeroplane.

The essential feature of the ambulatory system was a pressure suit, similar in appearance to present-day g-suits. The martian suit would have to be worn for continuous periods of several days, however, and accordingly would need to furnish a breathable atmosphere, ventilation, temperature regulation, feeding and elimination and to afford complete reliability. The projected surface vehicle consisted of a tubular chassis, wheel assembly (with brakes and low-pressure tyres), rocket turbine drive, fuel tanks, and a crew and equipment cab.

Design of the helicopter and fixed-wing aircraft hinged on the nature of the martian atmosphere, which was assumed to be composed of 96 per cent nitrogen, 3.7 per cent argon and 0.3 per cent carbon dioxide. Because there was no oxygen, all propulsion systems must be of the non-air-breathing kind. Atmospheric density of the martian atmosphere was guessed to be quite similar to that of the Earth at about 55,000ft altitudes. Other aerodynamic parameters such as Reynolds number and acoustic velocity also did not differ significantly from familiar quantities, and it was hence reasonable to postulate the design of aerodynamically (if "aero" is the proper prefix) supported vehicles. Rocket turbine power was forecast for the helicopter and aircraft alike. The former vehicle required low disc-loading and was of the inflatable type (as was the aircraft). A conventional high-wing configuration was suggested for the aircraft, which was to have twin engines driving propellers (or "rocket props"). Wing loading was of the order of 15lb/sq ft, which allowed take-off and landing runs less than 1,000ft. Design cruise speed was 180kt.

Four Douglas Aircraft Company representatives presented a paper, entitled *Entry Vehicles for Mars and Venus*, which discussed thermostructural design problems to be encountered in designing planetary probes. The martian atmosphere at upper altitudes was more dense than that of the Earth, and the mass of the atmosphere was more uniformly distributed between high and low altitudes (see first table). Consequently, the convective heat transfer (due to skin friction) became significant at just over one million feet altitude and was relatively uniform during descent.

PLANETARY ATMOSPHERE DATA (DOUGLAS)

	Earth	Mars	Venus
Principal components of atmosphere:—			
Nitrogen	79%	95%	10%
Oxygen	20%	trace	trace
Carbon dioxide	trace	5%	90%
Thickness of effective atmosphere (ft × 1m)	1.0	1.2	0.8
Surface pressure (lb/sq ft)	2,116	136	19,640
Surface density (lb/cu ft)	0.0765	0.0063	1.00
Average temperature of atmosphere (°F)	—9	—70	80
Acceleration of gravity at surface (ft/sec²)	32.17	12.95	28.30
Escape velocity at surface (ft/sec)	36,677	16,825	33,697

Surface atmospheric pressure on Mars was one-twelfth that of Earth and, with a lower pressure gradient than that of Earth, deceleration of a descending vehicle was more gradual and the heat transfer less severe. In conclusion, the authors stated that the design of Mars and Venus probes would prove quite interesting and a rewarding task for the future. Not only was the task feasible and economical, but it could be accomplished with existing materials such as aluminium or phenolic nylon.

Two Chance Vought engineers (Bilodeau and While) presented a treatize on the *Structural Design of a Manned Satellite Laboratory*. A three-man, non-recoverable 14-day scientific laboratory was envisaged which would have a separate re-entry vehicle. The design and construction of such vehicles was quite feasible, and would initially be used for qualification of life-support systems. Ultimately, however, they would be employed for other scientific and perhaps military purposes.

A 16ft long chamber was proposed, with 81in outside diameter. The laboratory would weigh 5,000lb (see second table), which limited booster selection to Saturn-class systems, and was to be orbited at a 300 n.m. altitude. Conventional aluminium sandwich construction appeared to be the best compromise from strength-to-weight considerations at elevated temperatures. The proposed laboratory had a good growth-potential and could be developed into a system wherein six individual modules were mated together in ring form to establish a large permanent space station.

WEIGHT BREAKDOWN (CHANCE VOUGHT)

	Three-man, 14-Day		Three-Man 30-Day
	Design based on loads	Design based on hazards	Growth version
Diameter (in)	81	81	105
Length overall (ft)	16	16	16.3
Weight breakdown (lb):—			
Shell	715	960	930
Internal support structure (shelves, seats, consoles, brackets, etc.)	375	375	500
Systems:—			
Environment (2 refills)	770	770	1,310
Food and provisions	85	85	190
Controls	740	740	970
Instrumentation	200	200	204
Displays and instruments	80	80	150
Guidance and navigation	25	25	100
Communications	60	60	330
Electrical power supply (batteries, solar cells)	1,100	1,100	2,500
Furnishing and miscellaneous	260	260	370
Payload	550	550	3,090
Total weight (lb)	4,960	5,205	10,644
Structural weight ratio (per cwt)	22.0	25.7	13.4

At the conclusion of their presentation the Vought engineers emphasized that much basic environmental data were required before any design could be "finalized." Other speakers and many in the audience echoed this view, and it was apparent that although environmental-type satellites received less publicity than some of the more spectacular space flights, they nevertheless constituted a vitally important part of any space programme.

A Boeing KC-135 tanker/transport aircraft is to be used for zero-gravity experiments by the Wright Air Development Division of the US Air Force. Trajectories giving a 40sec period of weightlessness will be flown at 25,000ft.

Garbled signals caused by a faulty diode in a "telebit" unit of the US artificial planetoid Pioneer 5 were overcome last month by devising a new translation code for the signals. At this time Pioneer 5 was 5.5 million miles from Earth and its signals were still being received by both Jodrell Bank and South Point, Hawaii.

A Martin Pershing selective-range ballistic missile for the US Army was successfully launched from Cape Canaveral on April 20. This was the second Pershing firing. The first stage burned for 50sec, sending the dummy second-stage some 35 miles over the Atlantic.

On April 22 the USAF (SAC 576th Sqn) successfully launched an Atlas from a "Hollywood-hard" coffin-type emplacement at Vandenburg AFB. A limited number of such partially hardened emplacements is programmed, although the majority of Atlas squadrons will be fully hardened (at Lincoln, Nebraska; Salina, Kansas; Roswell, New Mexico; Altus, Oklahoma; Abilene, Texas; and Plattsburgh, New York).

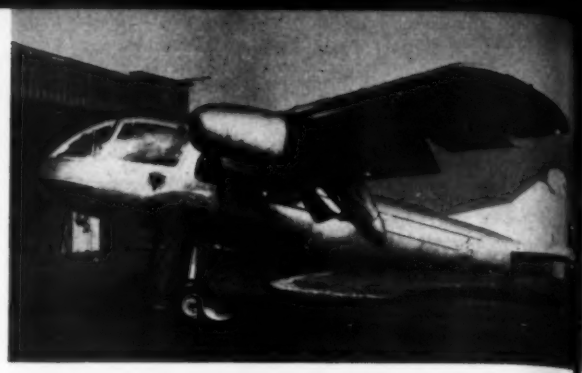
The Japanese Defence Board confirmed recently the signing of a contract with the US Navy for the purchase of 42 Tartar missiles to be delivered from Convair-Ponoma before the end of 1961. They will be used aboard destroyers of the Maritime Self-Defence Force. Japan will pay half of the overall cost of some $4,455,000. In addition, the JDA will import 24,800 Mighty Mouse spin-stabilized rockets and 60 Sidewinder missiles during the current Fiscal Year for a total of $1,469,444, and has allocated $241,000 for developing Japanese air-to-air missiles.

HANOVER ROUND-UP

Turbine Aircraft and Helicopters in the Air

By MARK LAMBERT

ILLUSTRATED MAINLY WITH "FLIGHT" PHOTOGRAPHS



Left, Herr Strauss, the German Defence Minister, prepares to fly the Lancashire Prospector, with the Earl of Bective, sales manager. Right, Claudius Dornier with the new DO 28. Top, the Do 29 which supports half its weight on tilted propellers. More power will allow VTO performance

As we reported last week, the Hanover Air Show is mainly a light aircraft exhibition and as such is probably the best outside America. During four days there I saw and flew more than I can describe in three pages and the two "In the Air" impressions which follow are those which are most significant, namely, the remarkable new engine control system of the Turboméca Astazou, which will also be a feature of the Oredon and Bastan, and the new turbine-powered S-62 helicopter.

Underlying the more light-hearted small aircraft show is the equipment sales drive centred on the static display and the news which can always be gathered there. It is apparent that Cessna are launched on a considerable expansion aimed at greatly increased foreign sales. First result is the agreement with Avions Max Holste, which may well lead to assembly or actual licence production of Cessna types in France, within the Common Market. Piper, it is reported, are busily seeking a similar arrangement. Beech have a momentary lead in application of turboprops in conjunction with SFERMA and Turboméca; but neither the Twin Beech nor the Travel Air are ideally suited to the Bastan and Astazou which they respectively have. The experience will nevertheless be precious.

It seems quite clear from Hanover that Rolls-Royce have all but concluded an agreement to make Continental engines under licence, but one of the stumbling blocks is lack of a market in Britain. Rolls-Royce will not produce without suitable aircraft projects in sight and the manufacturers either will not stir at all or are waiting for the engines to be ready. Auster seem to have chosen Lycoming, but Lancashire might well fit Continental. Someone must soon reach a decision. It also seems clear that the Bristol business twin, for so long an open secret, has been virtually abandoned.

General discussions with a wide variety of German and non-German personalities convinced me that Germany is a leading market—and especially in the Common Market sense. There was even a feeling that what the Germans bought the rest of the world would buy too. Certainly this has proved true of the F-104G, although few people seem to have any illusions about the great difficulty of producing that aircraft under licence in Germany. BMW, who are to make the J79 engine, have not yet received a production contract, although the first German-built aircraft is scheduled to fly in October 1961. They have a study contract and are preparing for the J79-7, which has the same power but improved controls. One of the main difficulties, apart from shortage of workers and factory floor space, is that the F-104 is to remain an "inches" aircraft, with NATO standard threads, yet must be produced on German machines by technicians accustomed to metric measurements.

No effort has been spared in selling to Germany, with the result that, in the equipment field at least, she has accepted a strange assortment of products. It seems clear that Germany is now in the same position as France five or six years ago. Her own equipment industry is only just getting into its stride and aircraft must rely on foreign equipment. A first necessity seems to be the stabilization of the situation by co-ordinated production in Germany either of home-designed or licence-produced equipment. Until now, NATO was the most hopeful co-ordinating authority and enforced some degree of standardization, but the Common Market, with its international co-operation, is now the better prospect.

In this rather wild and unpredictable competition British airframe companies are not well placed; but neither is anyone else. The HFB314 does not look a hopeful starter; and the Transall, the leadership for which is claimed by both German and French companies, is a long way off. But British engine and equipment manufacturers are doing a great deal better, largely by their own exertions. The British Government has long stood aloof or lent apparently ineffective aid to our industry and is only now beginning to take a constructive interest in those Continental projects which could provide work in Britain. There is an unfortunate history of almost incredible half-heartedness to be lived down. In the face of well-supported American and French competition it will now be a much more uphill struggle than it might have been a few years ago. In aeronautical selling, the British Government must convince the Continental market that it can once again be taken seriously and treated as a willing partner.

These impressions were gained from the high-powered part of the Hanover show. More obvious was the business and touring side of the show in which potential customers seemed almost as numerous as the casual spectators. For the salesman, the essence of the game was to keep his aircraft in the air and to catch the customers fresh from the admiration of a demonstration flight.

Through the melée of demonstrators the airliners operated from the main runway and the Do 27s of the Deutsche Taxiflug plied busily between the industrial fair and the airport. Based on Mannheim, the Deutsche Taxiflug operates a fleet of Do 27s all over Germany on immediate call and ran extensive scheduled services during the show. They will receive the first of the twin-engined Do 28s when they come off the production line in June or July. This new twin is intended as a taxi aircraft with full IFR capability in addition to STOL performance. With its two 255 h.p. Lycomings it is if anything overpowered, and should prove very attractive for tropical areas. I was able to fly the prototype at Hanover and an In the Air report will appear shortly. I was also able to fly the Pilatus Porter, which is a first-rate aircraft and deserves a brilliant future. Its performance at Hanover was outstanding and it is attracting considerable attention. The Prospector was also there, demonstrating its passenger-carrying and crop-spraying capabilities. I had time to gain some familiarity with this machine and to appreciate its good qualities.

NORD 1110 WITH ASTAZOU

in the Air

LAST year I heard about the remarkable control system which Turboméca had developed for the little Astazou 460 h.p. turboprop. I could not quite understand how it worked, and therefore made sure of trying it out at Hanover. In a great hurry I bundled myself into the Nord 1110 testbed, F-SCRY, with Gen Ladousse. We yelled at each other over the intercom, as the engine snarled like a giant buzz-saw. We taxied out, and all I saw of selecting take-off power was the pressing of a button marked "max." A great surge of power sent us rocketing down the runway and we climbed rapidly away. The r.p.m. needle was apparently nailed on 43,000, the fuel-flow meter registered 1,500 litres/hr, the j.p.t. wavered occasionally between 410° and 420° and, most puzzling of all, the pitch lever (the only powerplant lever in the cockpit) shifted restlessly into coarser pitch all by itself, eventually reaching about 34° (full pitch range was between 93° and −3°).

Eventually we levelled off at 2,500m (8,200ft) and flew at 125kt. Ladousse selected 23° pitch with the lever; j.p.t. and fuel flow came down slightly and stabilized and the thrust meter read a positive value (in piez). Then came the unique feature I had heard about. The nose was pulled up to reduce speed. Although r.p.m. and pitch stayed constant, the fuel flow, j.p.t. and thrust all rose to show an increase in engine power—although the engine controls had not been touched. With the nose still higher, the power increased until the j.p.t. reached maximum; then the pitch fined-off of its own accord. When the nose was dropped, thrust fell away and eventually became negative, with fuel flow and j.p.t. at very low values. A few zooms and near-stall turns followed; and always the thrust tried to balance out the speed changes, although the pilot did not touch the engine controls. I could not for the life of me see what parameter the pilot was selecting to produce this performance, nor how the engine varied its thrust in this way when r.p.m. and pitch remained constant.

The "max" button was again pressed. We were kicked forward to 160kt and the pitch went to over 30°, with the j.p.t. now nailed at 420° and fuel flow at about 1,500 l/hr. When the pitch lever was pulled back to 15°, thrust became markedly negative until speed had come down to 90kt, where it stabilized. This was the pitch-setting for the 90kt approach suitable for the aircraft and we settled into a 300m/min (984ft/min) descent. The general pushed the nose down to get 100kt: the power dropped and thrust reversed to send us downhill at over 800m/min—i.e., increase speed by 10kt and treble the rate of descent, but without changing pitch or r.p.m. He then pulled the speed back to 80kt: the power and thrust increased and the rate of descent markedly decreased. I say again, the pilot was not touching the engine controls.

After Practice—Theory

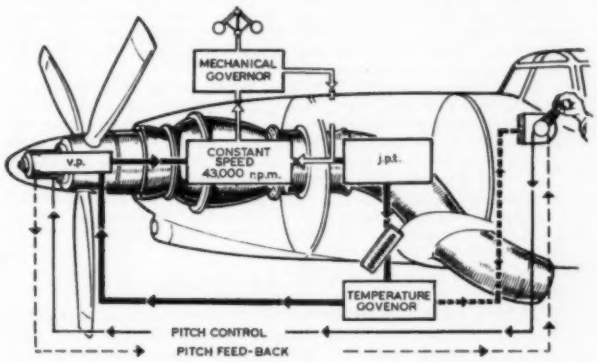
We made the complete approach and round-out with this single manipulation of engine controls, and touched down from a level float simply by slightly reducing pitch, which killed thrust immediately. Once on the ground we went straight into reverse thrust, by pulling the lever into the negative range past a gate. We taxied to our parking spot, the engine still at 43,000 r.p.m. and the three-blade propeller at 2,400 (from which neither had budged throughout the flight). After stopping, Gen Ladousse applied negative pitch and we shot briefly backwards before going ahead into the parking corner. At such r.p.m. the noise level was extremely high, but the propeller was delivering virtually no thrust and we could easily open the very large doors to get out.

I must admit that I was completely foxed by this self-adapting engine control, and settled down with Gen Ladousse to find out what made it tick. He first said that there were three stages in development: first came the fixed-pitch propeller, which varied its r.p.m. with airspeed; next came the constant-speed propeller which varied its pitch to maintain constant r.p.m. regardless of airspeed; and finally there was the Turboméca control, which varied engine power with airspeed changes. The last-named obviously marks quite a new departure in engine-handling technique, and one which makes a great difference to the ease of operation of turboprops. It is particularly welcome in business aircraft, or in specialized machines which must consistently perform semi-aerobatic flight patterns such as ground-attack. It also lends itself to automatic landing or approach, because the glide-path angle can be greatly varied with very small speed changes and power will automatically increase during the round-out so that the aircraft will reach the touch-down at zero rate of descent without manipulation of engine controls.

I thought the system must be expensive, but Turboméca say that it is very simple and actually reduces the price of the complete powerplant by 30 per cent. Noise on the ground could be considerably reduced by lowering the constant-speeding range, and a new reduction gear to give well below 2,000 propeller r.p.m. is being developed. The Astazou covers the 400 h.p. range, the Bastan goes up to 1,000 h.p., and the little Oredon is being developed for 300 h.p. and has already flown on the back of a Languedoc. At Hanover was the first of three twin-Astazou Beech Travel Airs, a Beech-financed project. The Astazou is, of course, too powerful for the Travel Air, but there are numerous fascinating possibilities of which Beech seem keenly aware.

Now for the control system itself. Basically it is like that of the Alouette helicopter, whose fixed-shaft Artouste constant-speeds with the rotor. When the collective-pitch lever is raised, the power demand of the rotor increases, and extra fuel is supplied to maintain governed r.p.m. In both engines, constant r.p.m. is maintained by a mechanical governor controlling fuel metering. In the Astazou, propeller pitch remains constant at a value selected by the pilot, the selection determining the average power the engine will give and therefore the approximate level speed of the aircraft. Actual power is indicated by j.p.t. and fuel flow and, in the Nord 1110, total engine thrust is shown by an aerodynamic system differentiating pitot pressure at a wing-tip and immediately behind the propeller disc. Thus, in the Nord 1110, 23° pitch will provide a high cruisng speed, whereas 12° will allow a 1,000ft/min descent at 90kt or level flight at about 70kt. These values can be calculated for each aircraft and would form part of the information in the pilot's notes. For a constant geometric pitch the aerodynamic pitch will vary with airspeed, because of the changing slip-angle. The only way in which the engine can automatically maintain its governed speed is for fuel flow, and therefore power, to be varied. If, therefore, airspeed is changed, the engine will automatically alter its power, reducing if airspeed increases and vice versa. The result is that the engine automatically adjusts its power to flight conditions, and a given pitch-setting tends to ensure a certain aircraft flight-path rather than a given power output. Constant-speed setting may be varied over a narrow band by a small winding handle; the 43,000 compressor r.p.m. used in the Nord 1110 test-bed represents 96.4 per cent of maximum.

So much for general flying, and the fascinating performance it produces. In the Astazou, the pitch of the Ratier-Figeac propeller is electrically controlled from a cockpit lever moving across a quadrant marked in degrees. Pitch control is to a fraction of a degree. Superimposed on the mechanical governor is an electrical j.p.t.-limiting system which automatically reduces pitch if j.p.t. limits are reached. If the nose is pulled very high, power increases in an effort to maintain r.p.m.; when maximum power is reached pitch is automatically reduced to maintain r.p.m. When the nose is pushed down, power is progressively reduced, until the pro-



Above, a schematic diagram of the Turboméca Astazou engine control system and, below, the Nord 1110 converted and tested by SFERMA

HANOVER ROUND-UP . . .

The Sikorsky S-62 at Hanover, preparing to taxi. At right is a view of the cockpit, showing main instruments arranged for the first pilot. The floor-level window is not fitted here

peller actually gives negative thrust (although still in positive geometric pitch).

As airspeed increases during and after take-off, a constant geometric pitch would give a steadily reducing aerodynamic pitch, and the automatic control would therefore progressively reduce power to prevent the r.p.m. increasing—or the pilot would have to keep pitch advancing (very accurately) to maintain maximum power. Turboméca have avoided this by providing a maximum-power governor working on j.p.t. To maintain both constant r.p.m. and constant maximum j.p.t. (and therefore power), it is simply necessary to press the "max" button beside the pitch lever. An amplifier in the j.p.t. circuit then automatically adjusts the electric propeller so that j.p.t. remain at 420°. Thereupon the pitch lever moves mysteriously forward throughout the take-off run and initial climb. Running at constant speed, the engine develops 80 per cent power from near-zero thrust in one second, and full power in between three and four seconds. Should the j.p.t. be exceeded, pitch is automatically reduced to 12° and automatic feathering may be provided. In case of engine failure in a twin, therefore, a button can simply be pressed to obtain virtually immediate and regulated full power from the other engine.

As an extension of this, Turboméca are planning to provide a similar automatic control for cruising power. So we can look forward to automatic full and cruising power, and automatic power control for manœuvring flight, approach and round-out, plus reverse thrust and airbrake effect or negative thrust for rapid speed-reduction or dive-speed limiting.

Reliability during the 1,500hr of flying so far completed with two Astazous has been extremely good, and the engine has passed three 150hr French type-tests. It is to be available for sale this year and is in production. Turboméca have really proved their genius with this system, but major credit is also due to SFERMA who, with Beechcraft support, have converted the Twin Beeches, Holste 153, Nord 1110 and Travel Airs and have handled the test-flying. CGTM have also done much development flying, particularly in proving the Bastan clip-on powerplant.

SIKORSKY S-62 in the Air

HELICOPTER representation at Hanover was not very wide, but included one of the Sikorsky S-62 prototypes, an Agusta Bell Super Ranger and 47G and a Sud Alouette II demonstrator. I wanted to fly one of these and chose the S-62, partly because I had not yet flown a constant-speeding machine and partly because it was the biggest and newest.

Weser Flugzeugbau, who represent Sikorsky in Germany, say they are prepared to build the twin-engined S-61 under licence if a Government order is received. At Hanover many German Air Force officers flew the S-62; the machine, gorgeously furnished for nine passengers and a crew of two, looked like a very smooth S-58 replacement. Its powerplant is a General Electric T58 with hydro-mechanical fuel control which derates it from its normal 1,050 h.p. to 900 h.p. Of this, 730 h.p. can be "pulled" in the S-62 for five minutes, and 670 h.p. continuously. The excess power is available to maintain sea-level performance in hot or high situations. The T58 is a free-turbine engine and the rotor and turbine are governed between 170 and 215 rotor r.p.m. Power turbine r.p.m. are noted in per cent on a separate dial and used in flight rather like the boost gauge of a piston-engined helicopter. Never-exceed limit is an indicated 95 per cent; but this is more than sufficient for hovering, and the only time when "boost" must be watched is during the take-off transition when collective pitch may be used to the limit. Otherwise the collective lever is purely an up and down demand control, without a twist-grip to worry about. This enormously simplifies flying and really takes the work out of it altogether.

When I leapt into the co-pilot's (left-hand) seat with Sikorsky pilot Pete Blanchard, this was about all he had time to explain before we had taxied to the take-off point just outside the main static park. From then on he was talking me through the standard power-on manœuvres and I was trying to cope with a control sensitivity which I have never before experienced. The Westland Widgeon on which I have been training has what I thought at first were virtually force-free, fully powered controls with very slight spring feel, but control movements can be quite considerable and little time is needed to get used to the feel. Yet I could barely keep the sensitive S-62 straight and level, and I saw a German Sycamore pilot do some violent rolling when he insisted on making his first take-off unaided.

Sensitivity for Ease of Control

Blanchard said it takes about two hours to get used to the sensitivity, but after that the S-62 is very pleasant to fly. For an almost unnoticeable force, full rate of roll or pitch resulted from what seemed to be between one and two inches of cyclic stick-displacement; but this meant that handling and manœuvring required virtually no exertion. The collective lever is also extremely light, but not nearly so sensitive, and the rudder bar is light and directional response very good. I saw the S-62 make turns on the spot in quite strong winds.

I first took control during forward flight at 80kt—well below normal cruising speed—and struggled for a while to keep level. The machine was exceptionally quiet and smooth, with only a faint once-per-rev vibration and little mechanical or airflow noise. With a very deep windscreen and floor-level windows visibility was excellent. Instrument arrangement and colour-marking were also very clear.

We made a few turns and then returned to a small pool set some 10ft below general ground level and surrounded by fences and bushes. Up to this Blanchard brought us; I following through on the controls, and I then hovered and lowered the S-62 into the water. Attitude changes were fairly large when seen from outside but barely noticeable from the cockpit. We rose out again and made a circuit to the original pad, where I slowed to a hover and made the landing. Transition was very easy from an approach at 60kt, because there was no boost to worry about and little directional reaction to power changes. The final surge of power to come to the hover was applied with a small collective lever movement and a slight yaw and could be done without any reference to engine instruments.

By this time I was beginning to feel the machine and to become fascinated by its simplicity and easy responsiveness, but I would have needed more time to get the knack of those sensitive controls. Incidentally, the seats are adjustable for height and reach, so that I could set mine to a height at which I could rest my arm on my knee to get steadier control. The stick was then about four inches from the seat, but movements were never large enough to foul it.

One point which Blanchard explained was that lateral control was difficult at first because the pilots' eyes were on the roll axis of the fuselage. Lateral displacements were therefore much more difficult to sense than if a roll movement actually caused the pilot's head to move perceptibly sideways, as it does in an S-55 or other types.

Engine starting on the S-62 is simple, involving an automatic cycle for starting the turbine, followed simply by movement of a hand throttle to obtain engine operating speed. The rotor brake is then released and the rotor accelerates smoothly to governed r.p.m. There is no clutch to be engaged.

"Flight" photograph

The Independent Outlook

Eric Rylands, Former BIATA President, Interviewed by Frank Beswick

IN another of his interviews with leading figures in the British independent air transport world, Mr Beswick discusses with Eric Rylands, managing director of Skyways Ltd and 1958-59 president of BIATA, the outlook for the independents in terms of operations and equipment. Mr. Rylands is the BOAC associated companies' nominee on the board of Middle East Airlines and its engineering associate MASCO.

WHEN first I met Eric Rylands he was chairman of BIATA, and I am bound to confess that for some time I thought he *was* BIATA. Those were the days when the British Independent Air Transport Association had quite modest annual dinners and Mr Rylands' executive energy was concentrated in the Lancashire Aircraft Corporation.

My first question was to ask how it came about that when the general trend was to absorb and merge, he had done just the opposite and cut off his first interest, the Lancashire company?

"You recall," he replied, "that at that time your Government were reserving the scheduled operations as a monopoly for the corporations. Our principal business was to the Isle of Man and we built up traffic there from one Rapide service a day in 1947 to 25 a day by the time we sold the company. This was made possible by the wonderful network of coach services which brought in people on a combined air-coach ticket from all over Lancashire to the air terminal. We tried to interest the shipping companies in this service, but when Silver City took over Manx Airlines we decided there was only room for one operator.

Do you think this process of merging will go much further? Is there a point at which we start losing efficiency as these units get larger?

"My view is that we shall eventually get three or four international independents and two internal operators. If all the little people could form into one or two groups then I think that is about it."

This is including Skyways as one of the four international companies, of course. But would you say your own position in relation to the corporation is rather different from others?

"Yes, that is certainly so. Our relationship has always been completely free, with no other reason or purpose behind it than the commercial advantage of both sides. My idea about co-operation will work out with BOAC regardless of any other political consideration. As long as the management of the corporation assure us that this is satisfactory from their point of view, then we are happy."

What difference will the new Bill make to you?

"None at all. We are already pledged to work with and not against the corporations, so that there is no intention on my part of trying to get any business which belongs to them."

How does this co-operation with BOAC work out in practice? What in detail are your arrangements?

"I have always thought that we could make a valuable contribution to the BOAC subsidiary companies. As you will know, in conjunction with David Brown we bought an 80 per cent interest in Bahamas Airways and we shall relieve the corporation of very considerable liabilities there."

In what other ways do you visualize this co-operation working out?

"We operate freight services to Singapore on behalf of BOAC and also their supplies flight. With Yorks, we are under an obligation to fly spares and other supplies anywhere in the world. We have a similar contract with PanAm. I would liken the role of Skyways to that of specialists on freight operations for the corporation."

In your own name?

"No, always in their name. I want them to be corporation services, although we are actually responsible for the operation."

Do you think that with aircraft like the Vanguard coming along there will be all this scope for operating a separate specialist freight service?

"The freight offered on the Atlantic is already fantastic. There is going to be plenty of business for the all-freight operator. Moreover anything which is too bulky or too dirty must go separately in a freighter."

Do you see this operation only as a means of utilizing old machines or with new equipment?

"With adequate utilization I would love to use Argosies. They are a perfect replacement for our present aircraft, although high utilization is essential. But I am sure that the traffic would come if the services were available. It is the old business of the chicken or the egg all over again. What is now needed is someone who is able to sweat it out long enough until they create the traffic demand. I am myself a great believer in freight. With pre-packed cargoes ready to wheel in, the potential with aircraft like Argosies is tremendous."

What about your other category of operations—the coach-air services? Is there a future for that very short-haul operation without any supporting longer haul business to go with it?

"The cross-Channel service may be a short-haul operation with a low price ticket, but we are expecting to carry 100,000 passengers this year. There is ample scope, for remember that something over 2m people cross by sea. What is really needed here, however, is a certain amount of rationalization on overheads. For example, today there are two airports within 15 miles of each other, with two lots of overheads, catering for the cross-Channel business.

"Incidentally, one extremely interesting feature of this business is the way in which it is attracting young people to air travel. A recent survey showed that something like 84 per cent of all our passengers on the cross-Channel coach-air service were under 25 years of age. The charm of the service is its friendly character."

What about these new possibilities—the Channel tunnel, Channel bridge, or hovercraft? Are they going to affect the cross-Channel air services?

"I doubt it. There may be some new ideas in the future, but for as long as I am in the business I don't think they will affect us."

I would just like to ask one further question about the shipping contribution. Shipping companies have a very considerable financial interest in all these independents, including your own, yet we hear so little about integration as between sea and air. Is there much that can be done? And do you think the shipping people have much of a contribution to make in management?

"In this intermediary situation I do not think they have a great deal of experience to offer as far as technical or commercial management is concerned. But clearly there is scope for an enormous saving if the sales effort was properly integrated and rationalized as between shipping and air companies. Also some form of loose arrangement on the main routes—interchange of tickets, for example—could obviously be beneficial. I imagine that people like the P & O, Cunard, Union Castle lines are looking twenty years ahead when it comes to a closer form of partnership. I do not think there is any conflict between the two forms of transport—the air operator can offer time and the shipping companies relaxation. Both are very important. In fact we ought to be looking at the whole business as British transport rather than separate shipping and air travel."

Details of the Lockheed-Azcarate LASA 60 utility aircraft, which recently gained its normal-category FAA type certificate, are given in the news-item below

Sport and Business

FIRST FLIGHTS of the new fifteen-metre sailplane designed and built by Elliotts of Newbury Ltd were made on Tuesday of last week (April 26) at Lasham. The aircraft was flown by David Ince, John Leach and Derek Piggott. Weights and performance agreed well with the predicted figures, and handling qualities were reported to be extremely good. According to Piggott, the new machine has the best handling qualities of all current British sailplanes, with particularly responsive aileron control. The serious flight-test programme on the aircraft was begun after the first-day flights without any modification being required.

Although the British standard-class entry for the world gliding championships at Butzweilerhof will be a Slingsby Skylark 2, it appears certain that the new Elliotts machine (which has yet to be named, or numbered) will be flown in the championships by another national team. The decision to include a Skylark 2 and not the new Elliotts aircraft in the British team was reconsidered, and confirmed, by the Council of the British Gliding Association at a meeting on April 13.

FUEL-INJECTION ENGINES are featured in the four new models of the Aero Commander which were announced on March 29 at the Aero Design factory at Bethany, Oklahoma. Illustrated below is the Commander 500A, which is typical of the new range. The main external differences compared with previous models are the much shallower engine nacelles and a new design of undercarriage which rotates through 90° during retraction.

The Model 500A, powered by two 260 h.p. Continental IO-470-M engines, has a cruising speed of 220 m.p.h. at 70 per cent power and a range of 1,420 miles at 45 per cent power with a 30min fuel reserve. Its sister-model the 500B is powered by two 290 h.p. Lycoming IO-540s and cruises at 225 m.p.h. at 70 per cent power. Both of these types have a normal fuel capacity of 130gal. The Model 560F (350 h.p. Lycoming IGO-540 engines) cruises at 234 m.p.h., and has a range of 1,500 miles at a normal fuel capacity of 186gal. The highest powered machine in the new range is the 680F (360 h.p. Lycoming IGSO-540 engines), with cruising and maximum speeds of 255 and 290 m.p.h. respectively. Later in the year a new 720A Alti-Cruiser pressurized version of the Commander will be introduced.

A TYPE CERTIFICATE has been granted by the US Federal Aviation Agency for the Lockheed-Azcarate utility aircraft now designated the LASA 60. Initial production of the machine will be at a factory at San Luis Potosi, 200 miles north of Mexico City, which is scheduled for completion this month, and the first production model is expected to be completed in October. The aircraft will also be built under licence in Italy by Aeronautica Macchi.

Powered by a supercharged 260 h.p. Continental TS-10-470 engine fitted with fuel injection, the production version of the LASA 60 will carry up to 1,500lb, with seat provision for six people. Alternative arrangements include its use as a 1,000lb cargo aircraft with two pilots, as a two-patient ambulance with attendant, or as a crop-duster. The combination of supercharged engine and high-lift wing with large Fowler flaps is intended to make the machine particularly suitable for operation from high-altitude bases during hot weather.

Data for the production version include the following:—

Span, 39ft 4in; length, 28ft 1in; height, 10ft 8in; empty weight, 2,024lb; normal take-off weight, 3,532lb; take-off distance to 50ft (sea level), 1,045ft; distance to 50ft (7,000ft), 1,350ft; rate of climb (sea level), 930ft/min; rate of climb (10,000ft), 820ft/min; maximum speed (sea level), 150 m.p.h.; stalling speed, 53 m.p.h.

FOLLOWING A RECENT BRIEF VISIT to Kidlington, the US pilot Max Conrad has accepted honorary membership of Oxford Aeroplane Club. At the club's a.g.m. recently, chairman Peter Clifford reported the excellent utilization of 790hr achieved by the club's Chipmunk during 1959.

ALOUETTE FLYING CLUB, based at Biggin Hill, has vacancies for new members wishing to fly the club's Taylorcraft at £2 12s and Auster 4 at £3 12s per hour. Members logged 75hr during the club's first six months' operations, and have recently been engaged in construction work on the clubhouse at Biggin.

PROVISIONAL PROGRAMME for the international rally which Skegness Aero Club is organizing on May 27-29 includes a dinner on May 27, triangular-course flying contest and dinner-dance on May 28, and *concours d'elegance* on May 29. Accommodation will be at the Seacroft Hotel, Skegness, and is limited to 100 persons; the rally fee is £5 10s and further information is obtainable from the club at Skegness Aerodrome.

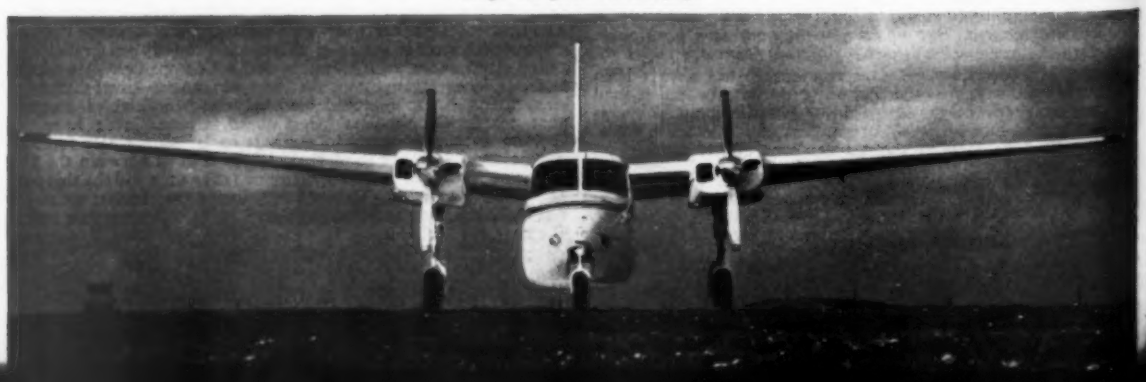
RETROSPECT

From "Flight" of May 7, 1910

A Dirigible in a Music-Hall: There is no accounting for popular taste in the matter of public entertainment, but we must confess one would scarcely expect to witness the spectacle of a fairly big model dirigible sailing about the auditorium of the London Hippodrome, where at the moment it constitutes one of the star turns. The dirigible in question is fitted up with wireless control, and the operator, Mr. Raymond Phillips, makes it travel where he will, more or less, by the diligent rapping of an electric key on the stage . . .

As an indication of a phase of aeronautics that is quite likely, indeed, we may as well say quite certain, to figure in the future, this display at the Hippodrome is a thoroughly interesting and instructive turn, and brings before many hundreds of people a visual demonstration of a scientific subject that in the ordinary course of events they would only be likely to read about at the best. The mere fact that they have seen a model dirigible controlled without wires will enable them to take a little more personal interest in the real thing when it comes, and if this sort of show proves popular for any length of time we shall really become quite an intellectual race.

A 12 per cent decrease in drag and a marked reduction in noise are claimed for the distinctive new engine nacelles of the Aero Commander, which feature upper-surface exhausts and are shown to advantage in this photograph of the Model 500A. Details of the new Commander range are given on this page



RED BERET SOLDIERS

Training at Aldershot and Abingdon

Text by Humphrey Wynn
Drawings by Gordon Horner

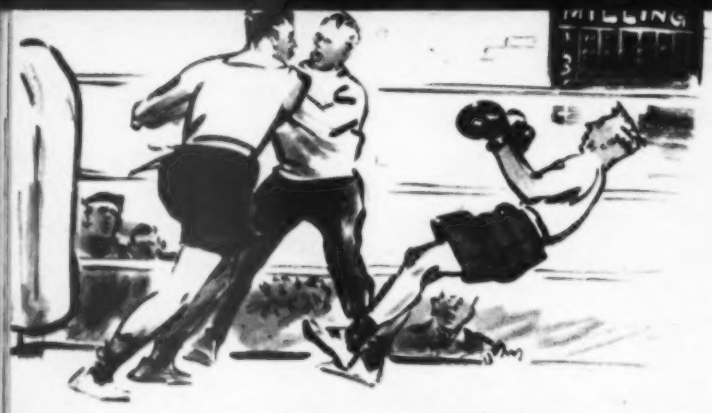
EASILY the most impressive part of an airborne exercise is the staccato exit of parachute soldiers from the doors of a Hastings or Beverley. One-two-three-four-five-six they come, without a moment's hesitation. It looks almost automatic, like marionette figures jerking to strings; but each individual exit is a compound of training and discipline acting on a human brain and body to make it leap into space—not the most instinctive thing for a man to do, especially when he is weighted down by a weapons container and reserve parachute.

If a soldier is to be persuaded to do this, and to go into battle as soon as he is on the ground, the type of training he receives must necessarily be rigorous. Visiting the Aldershot headquarters of the Parachute Regiment, where the training begins, the layman wonders not that airborne soldiers are tough but that they ever survive what might be called the chrysalis stage. Two streams (to use current educational parlance) come to the Regiment for initial training: civilian recruits, and soldiers from other branches of the Army. The ex-civilians are given ten weeks' basic training to make them into infantrymen; while the object of the course given to those who are already soldiers is to see whether they have the qualities required by the Airborne Forces.

No basic parachute training is done at Aldershot: that is the task of No 1 Parachute Training School, whose activities are described subsequently; but many of the Aldershot tests include flying through the air, with or without the aid of ropes. In a beech wood south of the A325 road to Farnham are various cunningly devised structures made of tubular scaffolding, which have to be climbed or crossed without hesitation, and with the minimum of footholds. Tiny platforms have been built high up in trees, leading to a gap which must be crossed by a leap or with the aid of a swinging rope. At crucial points the participant must stand still and call out his name, rank and number, to ensure (as an RSM put it) "that he is in full control of his senses." Some of these man-made hazards are depicted in the accompanying drawings—which, vivid though they are, cannot do full justice to the skill of those who devised the tests and the thorough-going efficiency with which they are applied. Any soldier who embarks on this course (all are volunteers) must have a good head for heights and possess cool nerves; he must learn to tackle what look like insuperable obstacles without a moment's hesitation, even when conditions are most trying and difficult. One quality specially looked for is a man's ability to keep going when his morale is low through physical discomfort and fatigue. As Lt-Col J. Awdry, who commands the First Battalion, put it: "If you know what people are like when they are tired and cold, you have a good idea of what they are really like."

The tests and games try out a man's aggressive spirit; his

Crossing a gap by means of a swinging rope (left) is one of the tests which Parachute Regiment trainees undergo at Aldershot, to learn to leap fearlessly into space. Above, the log race teaches endurance and team spirit; and below, cool nerves and a good head for heights are needed on top of the scaffolding



"Milling"—an all-out combat urged on vociferously from the ringside —inculcates fighting spirit and forms part of the Aldershot curriculum

RED BERET SOLDIERS . . .

muscular co-ordination is assessed by work in the gym; his endurance by 3½-mile runs, a steeplechase and an asssault course. Teamwork is a strong feature of Airborne Forces' training at Aldershot: one of the toughest examples of it is the log race, in which about four teams of eight to ten men in each compete against each other over a hilly three-mile course, with no holds barred when it comes to putting obstacles in the other teams' way, and every man in each team having to carry on to the end. The object of this training is to create the type of soldier needed in airborne forces: self-dependent, able to work coolly with others under difficult circumstances, tough and extremely fit. With this work-out behind him, the parachute soldier goes forward for his parachute training at Abingdon.

In one corner of a hangar at No 1 Parachute Training School, RAF Abingdon, hangs a replica of the gaily-coloured inverted parachute under which Robert Cocking lost his life in 1837. Cocking—who was a water-colour painter by profession—seems to have based his experiment on the advocacy by Sir George Cayley of an inverted parachute, its dihedral angle providing stability in descent and so obviating oscillations. Unfortunately the pioneer made no experiments of any kind; and when he was released at 5,000ft after being taken up by balloon from Vauxhall Gardens his canopy folded up after its ribs were broken by the initial acceleration, so that he plummeted fatally to earth.

Cocking's parachute, a melancholy reminder of the price paid by brave (or, in his case, foolhardy) experimenters, looks down upon a scene which he would have regarded with astonishment. On the hangar floor and around its walls are pieces of apparatus designed to simulate the main facets of jumping—exit from an aircraft, control of the parachute during descent, and landing technique. The exit trainer, looking rather like a large pigeon-loft, is high up at one end of the hangar. It gives embryo parachutists the sensation of an initial fall from the aircraft before their parachute opens. Elsewhere in the hangar there are rings, ramps, slides and block-and-tackle equipment, on which the instructors teach the trainees the fundamentals of parachuting—within easy reach of gymnasium-like matting on the hangar floor. These PJIs (parachute jumping instructors) each have a section of eight or fewer men and stay with them throughout their four weeks' course. It is most important to induce confidence and keep up morale; drills must be driven home so that they become automatic; and every precaution must be taken to avoid mistakes, which may have serious consequences.

In the middle of the hangar are two gantries, known as "elementary flight trainers" and capable of supporting six trainee parachutists on either side. This equipment helps to teach the correct position on the way down, enabling the instructor to demonstrate what the parachutist should do with his legs and arms. At one side of the hangar is the block-and-tackle flight and landing trainer. On it, newcomers are taught how to land correctly, keeping their feet and knees together. This procedure comes in the second week's training at Abingdon. In another hangar nearby are two wooden mock-up fuselages, of a Hastings and Beverley, so that parachutists in training can learn the drill they are to follow in the aircraft. In the open is a 70ft high tower from which controlled descents are made (rather like the reverse of

Learning the fundamentals of parachuting in the training hangar at No 1 PTS, RAF Abingdon

Exit in good order: the end-product (right) of instruction at Abingdon as trainees make their first "live" descent from a Hastings of Transport Command, putting into practice all they have hitherto been taught on the ground. Below is shown one of the preliminaries, a descent from the gantry; and as tailpiece, an assault course hazard

a ski lift), to teach approaches to the ground and actual landings.

All this would no doubt have fascinated Robert Cocking, and it demonstrates how cut-and-dried parachuting has become (largely through its wide military employment in the last war) compared with precarious early experiments. It is now almost 20 years since No 1 Parachute Training School opened at Ringway, Manchester (in 1940), and No 510 Course is just about going through Abingdon. This month the school is making a new departure with the Army pupil course in free-fall parachuting, a technique which some of the instructors studied last year at the French Army Parachute Training School near Pau.

As a painter, Robert Cocking would quickly have noticed the difference in colour between the uniforms of the Abingdon instructors and their pupils. The former are all RAF, the latter mainly regular Army or TA. "Mainly" implies certain exceptions, and these are u/t RAF parachute instructors; AQMs of Transport Command, who are trained to assist in dispatching but can jump if they wish; RN and RAF personnel on AMO courses, who do four jumps, two from a balloon and two from an aircraft; WRAF personnel, who can do two jumps from a balloon; and physical fitness officers, who come to Abingdon for a fortnight and do two descents from a balloon and two from an aircraft and may volunteer to train as PJIs.

But the majority of trainees at No 1 PTS at any one time are the 300 men who make up the two Regular and two TA basic courses. The source of the Regulars has already been described in the first part of this article, from the two streams which come to Aldershot, of volunteers from Army units or recruits who are joining the Parachute Regiment from "civvy street." The TA men do evening or weekend training with their units and 15 days' summer camp; they are supposed to be reasonably fit when they come to Abingdon, though they can hardly have acquired the same kind of resilience inculcated by the Army at Aldershot, and it is a tribute to their keenness that they go straight from office or factory environments into the disciplined adventure of parachute training.

Once the trainees have learned the fundamentals at ground level, and acquired some confidence, they are given their equipment, which basically means two parachutes. (The reserve parachute was introduced four years ago. Carried at the front, it makes it more difficult for the parachutist to see the ground immediately beneath him. It also adds 13lb to his total weight.)

During the four weeks' course at Abingdon, eight training descents are made, the first two from a balloon (at 800ft) and the remainder from aircraft, including two with weapon container and one at night (though the TAs do not do a night descent). The half-dozen jumps from aircraft are made (1) in consecutive sticks of three, (2) simultaneous sticks of three, (3) simultaneous sticks of ten, (4) with equipment, in sticks of five, (5) by night and (6) *en masse*, 40 to 60 men deplaning at a time. The DZ for these training exercises is Weston on the Green, a disused grass airfield near Bicester, from which the troops are brought back to Abingdon by coach. Aircraft used are Beverleys from the resident squadrons, Nos 47 and 53, or Hastings from Colerne; for training purposes, the Hastings carry 32 parachutists, the Beverleys 70.

All the instructors at No 1 PTS have been through a much more comprehensive training programme than their pupils, on a course of about 14 weeks. In the first month they take the course given to Army personnel, to equip themselves with basic techniques and also to taste instruction from the receiving end. The second month they spend learning how to be instructors; in the third, they put their training to the test by taking charge of a section under the eye of a qualified PJI. Trainee instructors complete their course with practical experience of water descents, selecting and marking DZs, and parachuting with special equipment.

Although the PJIs at Abingdon are all RAF officers and NCOs, and the Army staff are responsible for administration and discipline, there is what both sides describe as "a happy relationship" between the Army and RAF at No 1 PTS. For the Army, the senior officer, Maj J. N. Sim (OC Parachute Course Administrative Unit) pays tribute to the co-operation and friendliness he receives at all times; only on matters of pay and discipline is the Army independent at Abingdon. There are three squadrons at No 1 PTS, two of them (A and B) giving basic training and the third (C) a support flight. The commander of the school, Wg Cdr E. J. Brice, explains that its title is not an anomaly although it is in fact the only military parachute training unit in the UK. If conditions necessitated, two of the squadrons could be "hived off" to form the basis of other schools.

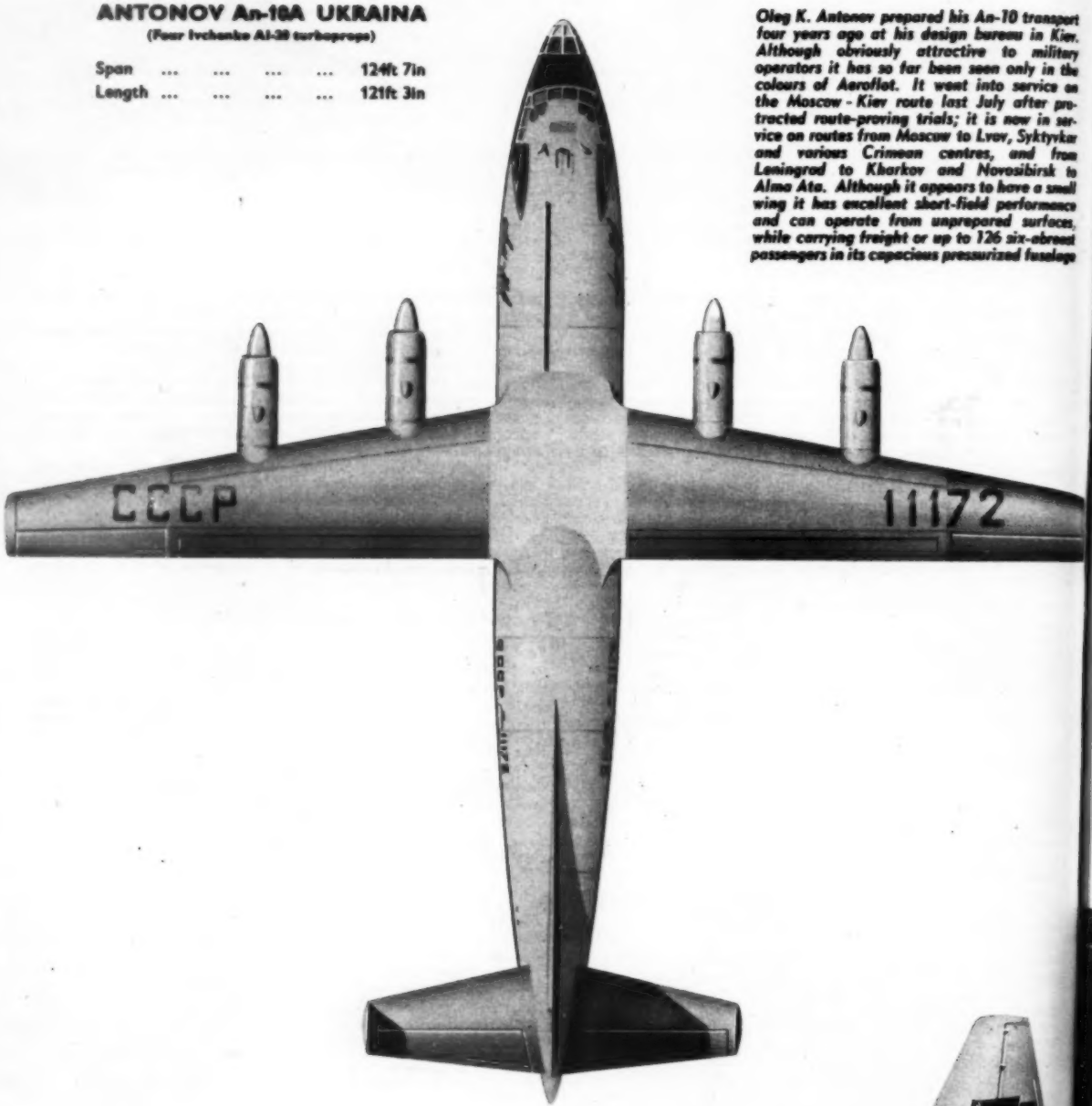
It is "C" Sqn which will be responsible for the free-fall course due to start at Abingdon this month. The trials officer, Flt Lt Peter Hearn, was one of the four instructors who went to the French Army's Parachute School near Pau to study their free-fall techniques; and now the benefit of this experience is being passed on. It was Flt Lt Hearn, too, who showed *Flight* round No 1 PTS and provided an authoritative and courteous commentary. His frank and modest personality showed the calibre of instructors at the school, and their high sense of responsibility. He stressed that instructing "involves teaching men who are under considerable mental strain." Personality was important in building up confidence between instructor and pupils, and getting things across. Once the fundamentals have been taught and live jumps are to be made, the weather must be watched carefully and the instructors have to decide whether conditions are suitable. At No 1 PTS the trainees, have something more than instruction transmitted to them. They receive inspiration and enthusiasm from their instructors for what still is, despite the advances in techniques and safety since Cocking's day, a dangerous occupation. The Army still has to fight its battles on the ground; but as far as training parachutists goes, it is in good hands at Abingdon.

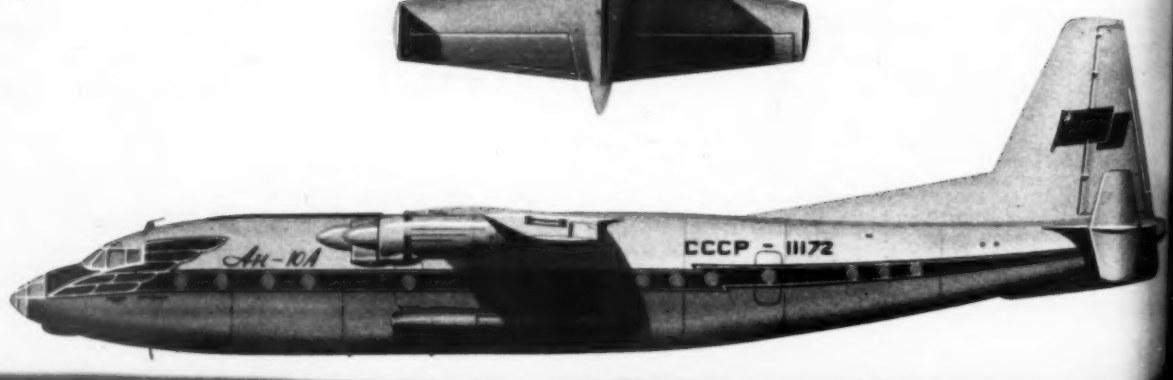
ANTONOV An-10A UKRAINA

(Four Ivchenko AI-20 turboprops)

Span	...	...	...	...	124ft 7in
Length	...	...	...	...	121ft 3in

Oleg K. Antonov prepared his An-10 transport four years ago at his design bureau in Kiev. Although obviously attractive to military operators it has so far been seen only in the colours of Aeroflot. It went into service on the Moscow - Kiev route last July after protracted route-proving trials; it is now in service on routes from Moscow to Lvov, Syktyvkar and various Crimean centres, and from Leningrad to Kharkov and Novosibirsk to Alma Ata. Although it appears to have a small wing it has excellent short-field performance and can operate from unprepared surfaces, while carrying freight or up to 126 six-abreast passengers in its capacious pressurized fuselage

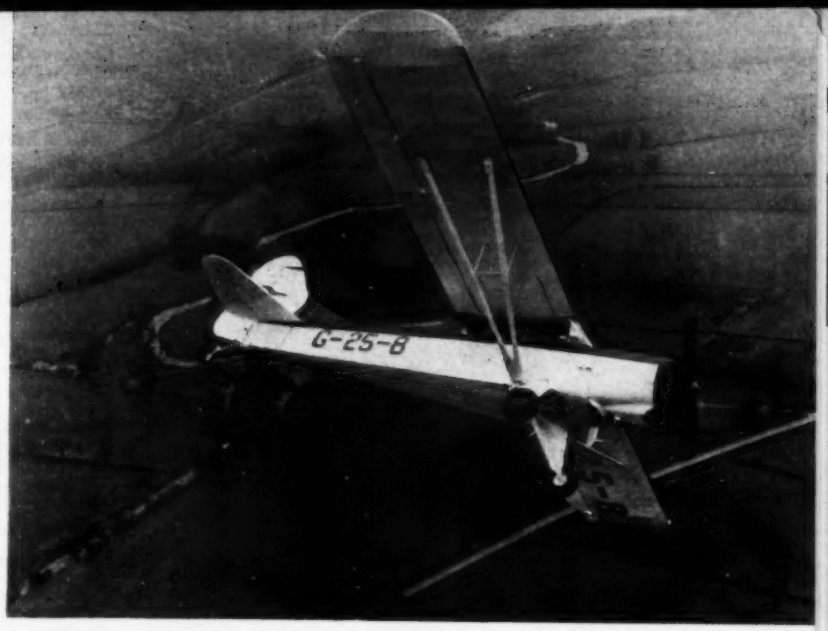




AUSTER D.4 in the Air

By ALASTAIR PUGH

No 118 OF THE SERIES



"Flight" photographs

AFTER a couple of rounds of "In the Airs" tackled in conjunction with colleague Mark Lambert, for a solo performance I was able to fly the prototype Lycoming-powered Auster D.4. Latest of the Auster line, this first D.4 heralds a whole series of Lycoming-engined aeroplanes. The D.4 is a two-seater, the D.5 seats three and the D.6 four, but there is a high degree of interchangeability among them. There is, for example, a choice of three engines (108 h.p. O-235, 160 h.p. O-320 or 180 h.p. O-360 Lycomings) and of two sets of mainplanes, either of 32ft or 36ft span. Permuting and combining, 11 practical variations can be made, from a very crisp two-seater with short wings and 180 h.p. in the nose, to a four-seater with generous load-carrying abilities in hot climate conditions. Given a variable pitch propeller (one of the many optional extras), spats and cuffs around the struts, the two-seater should cruise at not far short of 150 m.p.h. At a price of under £4,000, Auster remark that this is selling performance probably more cheaply than in any other production aeroplane anywhere in the world.

One D.4 and a D.5 have flown so far, and another half-dozen or so are taking shape on the line at Rearsby. The 108 h.p. Lycoming-powered D.4 that I flew made its debut at Goodwood on Easter Monday and is representative of production models except in respect of its wings and ailerons, which are of the early standard (J1N for example). All the D series—long and short span—are to have wings with metal spars and the greatly improved Aiglet-type ailerons with extended aerodynamic balance. Apart from this, the remainder of the airframe is the well-tried mixture as before. But there is a steerable tailwheel, strut roots are cuffed and the interior—although simple—is soundproofed, carpeted and headlined and brought a bit nearer to the 1960 standards of the Auster's more exotic competitors.

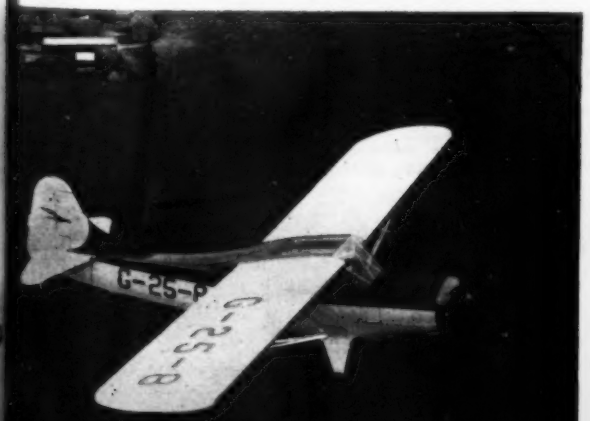
My first impressions on clambering in were that, while I was at home in familiar surroundings this was a more pleasant cockpit than that of any Auster I had previously flown. Although the bench-type seat is not adjustable, pedal reach suited my particular height very well and controls, as they say, "fell to hand." Power is varied by a push-pull knob with a grub screw damper, and this is supplemented by a carburettor heat adjustment and a mixture control with idle cut-off. Fuel from the 16gal starboard wing tank (a port tank is optional) is selected by a guarded lever in the floor and checked by a direct-reading gauge in the wing root; to start the engine it is simply a matter of flicking up the master and magneto switches and pressing the button. The Lycoming catches easily and settles down right away.

Taxying is no different than with other Austers, except that light weight and soft bungees improve the ride; soundproofing over the bungee box also makes it a good deal quieter and the purr of the Lycoming is a positive joy. Forward view is very little impaired by the increased width of the neatly tailored nose cowl, and the heel brakes and steerable tailwheel can be used to such advantage that I found I could reverse direction completely in a radius of under 10ft.

With one pilot and about nine gal of fuel the D.4 swung little or not at all, unstuck smoothly and easily at about 40 m.p.h. and gained airspace very quickly. I timed the passage of the thousand feet between 500ft and 1,500ft—climbing at the recommended 70 m.p.h.—at 1min 15sec, which agrees rather well with the 800ft/min measured by Auster's chief test pilot, Ranald Porteus, with the D.4 in the same condition.

Visibility from the left-hand front seat varies from good to rather poor. Forward and downwards it is completely satisfactory, notwithstanding the slightly longer nose of the Lycoming cowling. This, incidentally, is identical for all three engines; only the engine bearers for the 180 h.p. six-cylinder make the installation different. Although the roof is no longer completely glazed, view through the overhead and rear quarter lights remains good, though the blanking of the wing root tends to encourage well-banked turns.

As soon as I had levelled off, I closed the throttle completely and waited, ailerons gently waggling, for the stall. Lateral control was there right down to 36 m.p.h. i.a.s., at which speed right wing and nose dropped away with no detectable warning. Recovering in 100ft, I tried again with take-off (22°) and then landing (50°) flap; there was no more warning than before but the stall was equally innocuous. I recorded indicated speeds of 32 and 27 m.p.h. under these conditions and when, nose very high, I got the D.4 to the point of stall under full power, the needle was



Unmistakably Auster, the D.4 cockpit is more effectively silenced than those earlier models. Left, the aircraft's new shape includes limited roof windows and a dorsal fin. The fin graces the 108 h.p. machine in the interest of interchangeability, but it also adds to directional stability. Controls are standard except for Aiglet-type ailerons

Note in this view the new cuffs on the struts. Registration letters have not yet been allocated to this two-seater prototype

AUSTER D.4 in the Air . . .

nearly off the dial of the clearly calibrated a.s.i at 22 m.p.h.

Engine response to fast throttle movement is near-immediate and it doesn't take long for the D.4 to settle to its cruising speed of 92 m.p.h. i.a.s. at 2,350 r.p.m. Although it is quieter than others of the tribe, I was a little disappointed at the way noise level increased between 2,100 and 2,350 r.p.m. I think the exhaust begins to crack at these revs and I was subsequently interested to hear that a longer pipe is under consideration.

Up to this point I had been flying Auster's new two-seater without making much conscious attempt to assess control harmonization. This I think speaks for itself; it is inconspicuous by its presence, and if the production ailerons are a shade lighter than those fitted now the D.4 should be very pleasant indeed. The short-span 32ft wings should crispen up the performance and handling even more and in fact stressed harness and seats would then make the D.4 aerobatic.

The speed range is admittedly not great (V_{NO} is 111 and V_{NE} 140 m.p.h.) but throughout it the controls remained effective, response was good in each axis and hand and foot forces were commendably light. On the ground I had noticed that elevator and aileron forces were higher than those in a J1N which I had flown during our photographic sortie; but there was no appreciable backlash or breakout force and the effect may have been the result of grease drag in new bearings.

At its cruising speed, I found the D.4 stable in pitch, neutrally stable in roll and stable when yawed to the right, just unstable when yawed to the left. Damping was moderate in pitch and a 5 m.p.h. speed increase required four pitch cycles before trimmed speed was regained. Repeating the exercise at a trimmed speed of 60 m.p.h. it was noticeable that these phugoid oscillations were of much shorter term and more pronounced; damping was also less marked but the aircraft was demonstrably stable and would regain trimmed speed.

There are moderate changes of trim with power, which could be coped with by about one-third of the range of the roof-mounted winder. This control worked well on the D.4 and exhibited little free play, but I confess that backlash in other examples on older aeroplanes makes me suspicious of roof handles as a trimming system. A pleasant surprise was the very moderate nose-up change of trim when flap was lowered. These are still worked by the pull out and heave flap lever long favoured by Auster (is it too late to suggest that a pawl and trigger would make the control simpler to operate?) and once the pull-out lock has been disengaged the force to lower is reasonably light. Limit speed is 70 m.p.h.

Overshooting with full flap is completely straightforward and the push force required before re-trimming must be under ten pounds. There is obviously a lot of drag, but I found that a transient rate of climb of around 400ft/min could be easily obtained. A slight tendency to sink when the flaps are raised can be minimized by lifting them slowly against the aerodynamic pressure—and it's rather fun to feel what is going on outside.

On the approach the D.4 settles happily to a trimmed speed of about 50 and touches down as lightly as thistledown. There is plenty of elevator control for a three pointer both at this speed and 5 m.p.h. slower, even on a slightly adverse slope.

The D.4 is not a revolutionary step forward, but for my money the D series should be the best Austers yet. Ruggedness and accessibility have always been good features, and now comfort, quietness and finish have been much improved. The clean and sweet-running American engines are an obvious choice for aeroplanes of this class and lend themselves well to optional appendages such as heaters, v.p. propellers and silencers. There is still some way to go in finding British equipment to bring this British aeroplane up to the *prix fixe* standard of its US contemporaries, but in one respect the D.4 is comparable or better in every way: it shows promise that in its definitive form handling may be very good indeed.

AUSTER D.4/108 (LYCOMING O-235)

Dimensions: Span, 32ft or 36ft; length, 23ft 4.5in; height, 8ft 1in. Weights: Gross, 1,900lb; empty, 1,283lb. Performance (pilot, passenger, full fuel, 30lb baggage, 36ft span wings. Measured figures reduced to ISA conditions): Max level speed, 111 m.p.h.; cruise at 2,450 r.p.m., 98 m.p.h.; cruise at 2,350 r.p.m., 92 m.p.h.; absolute ceiling, 16,000ft; take-off ground run (5kt wind), 450ft; take-off to clear 50ft, 1,250ft; initial rate-of-climb, 620ft/min; range (16 Imp gal), 250 st m; range (32 Imp gal), 500 st m. Price: £3,020.

WILLIAMSON'S NEW CAMERA

A NEW Williamson camera has been taken into service by the Royal Air Force, chiefly for use by Coastal Command. This is the F117, which is equally suitable for air-to-air and air-to-ground photography. It can be either hand- or motor-operated and be hand-held or placed in a fixed installation. One of its main, and most interesting, features is that of rapid sequence. Despite a format of 4½in square, exposures can be made at a rate of two per second.

Originally a private venture, the F117, in addition to being accepted by the RAF, is now being demonstrated to the Royal Canadian Air Force, and the West German Air Force is sufficiently impressed to have ordered two trial examples. This latter order, coming as it does from the home of camera manufacturers, is an undoubted feather in the Williamson cap.

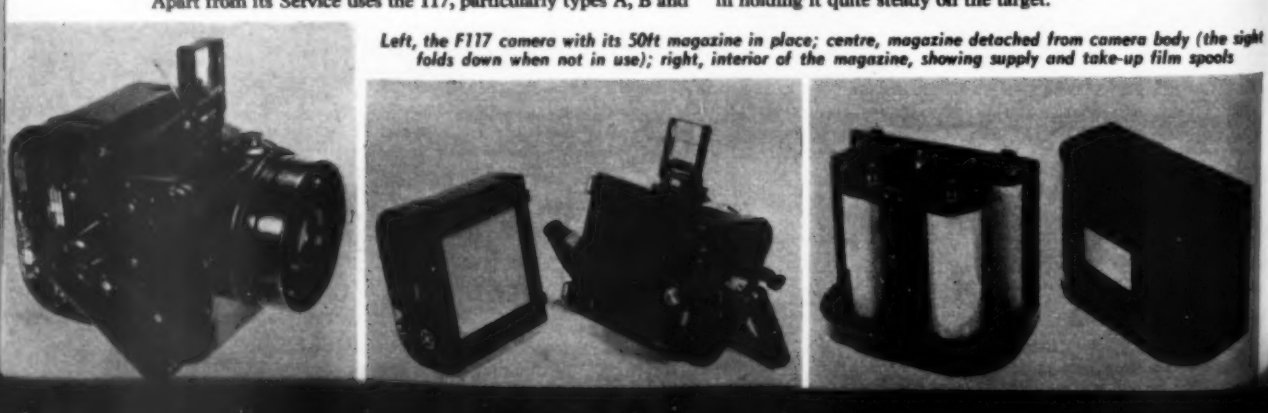
The various sub-types, available or in the process of development, are: F117A—hand-held and hand-operated; F117B—hand-held, hand-triggered and with motor rewind from remote supply; F117C—fixed installation, remotely triggered and with motor rewind; F117D—as C type but with provision for image-improvement compensation (for use with high-speed aircraft); F117E—as B type but with built-in batteries taking the place of remote current supply.

Apart from its Service uses the 117, particularly types A, B and C, should be of interest to the many smaller air photography operators the world over. For low, hand-held obliques of such objects as buildings and ships it is an excellent instrument. Its low weight of 14½lb, complete with loaded magazine, makes it very suitable for installing in light aircraft for vertical photography. Each magazine, loaded with 50ft of 5in film, weighs only 3lb and gives 120 exposures. Change of magazine can be made easily in the air.

Shutter speeds available are 1/60, 1/125, 1/250 and 1/400 second, instantly selected by the turn of an outside indicator. The iris diaphragm setting of the Ross f/4.5, 6in lens is also quickly adjusted by means of a simple external control. Provision is made for fitting light filters.

The 117 is claimed to be able to operate satisfactorily over a temperature range of −20°C to +50°C and to a specified accuracy between −5°C to +35°C. For vertical installation the effective dimensions of the new camera are: height 11$\frac{7}{8}$in, width 12½in, depth 8½in.

In use it was found to come very comfortably to the hands, and the trigger to be convenient for operation and of a size and pressure appropriate for use in an aircraft. Even when using the camera at its minimum cycling time of 0.5sec, no difficulty was experienced in holding it quite steady on the target.



Left, the F117 camera with its 50ft magazine in place; centre, magazine detached from camera body (the sight folds down when not in use); right, interior of the magazine, showing supply and take-up film spools

Straight and Level

IF you are feeling a little depressed about the £65 million spent on Blue Streak, you can derive negative comfort from the following recent reported conversation between George Mahon, chairman of the US Congress sub-committee on Department of Defense appropriations, and Gen Ritland, USAF:—

Mr Mahon: "I would like to know what we are paying in the Air Force for manuals for the missile programme."

Gen Ritland: "All of the missiles, the total?"

Mr Mahon: "Yes, I have some information to the effect that it runs into many millions of dollars."

Gen Ritland: "It is costly. However, the complexity of all missiles and all the ground support equipment requires manuals for training operators and for maintenance and repair."

Mr Mahon: "This is a field which is quite expensive, but to spend $40 or $50 or $100 million on manuals would seem almost beyond comprehension. Do you know about this, General?"

Gen Ritland: "Yes, sir."

Mr Mahon: "How much?"

Gen Ritland: "It runs in the order of $100 million."

● A certain aircraft is to be delivered to the customer, says its manufacturer, in the "summer of 1962." Does this mean May 1, 1962? Or does it mean September 30, 1962? The possible difference is five months—a fairly india-rubbery schedule.

I am, I know, remounting an old hobbyhorse. But I do wish that British manufacturers would be more precise in this rather important matter of publishing delivery dates. Coyness inevitably suggests that the industry doubts its own ability to fulfil its contracts.

We might do well to remember that we are competing with an industry which says not only that it will deliver in a certain month; it sometimes specifies the exact day of the month.

I have therefore prepared the Roger Bacon Delivery Date Conversion Table, which I recommend should be adopted by the SBAC (and all industry PROs) as a standard work of reference:—

Manufacturer's published evasive delivery date	Proposed meaning
"First half of the year"	January
"Early in the year"	January
"First quarter"	January
"Early spring"	February
"Spring"	March
"Late spring"	April
"Second quarter"	April
"Early summer"	May
"Summer"	May
"Mid-summer"	June
"Middle of the year"	June
"Second half of the year"	July
"Third quarter"	August
"Late summer"	September
"Autumn"	October
"Fourth quarter"	October
"Late autumn"	November
"Winter"	December
"Late in the year"	December
"During the year"	*

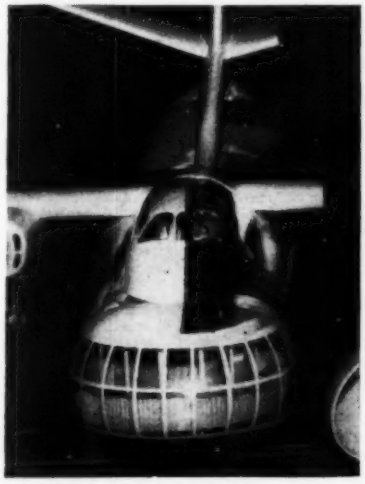
*This beats me.

Catering Department

... THE MINISTER OF AVIATION (MR SANDYS) WAS CONSIDERING WITH FIRMS CONCERNED WHETHER THE BLUE STREAK MISSILE COULD BE ADAPTED AS A LUNCHER FOR SPACE SATELLITES.

A B.E.A spokesman said later that there were no personal injuries but the tail of the Pionair was badly given luncheon and left later damaged. All passengers were in a replacement aircraft.

To add to these two news cuttings is the *Punch* cartoon caption which provides the best comment yet on the proposed co-operation with the French in supersonic airliner design: "We tackle the design," says the British representative at an Anglo-French meeting, "and you handle the catering."



Believed by scientists to have been extinct for 3,000,000 years, this remarkable creature—indentified by experts as the H.P.R.8—was brought to light during recent investigations into a tunnel under the English Channel

● Very often, when an accident nearly happens, a pilot will say, sometimes to himself, sometimes to another: "If an accident *had* happened no one would ever have known the cause." This is why I think the motto of the Flight Safety Foundation, "Share your experience," is so good—and why this short story is salutary:—

Over a period of several months 26 USAF fighters of a particular type suddenly dived into the ground in a 45° left bank during instrument approaches. The cause was eventually found to be dizziness induced in pilots when they looked down to change radio channels by means of a selector located near their right hip.

● Reported exchange between Lord Douglas, chairman of BEA, and jet noise demonstrators:—

"Tests have proved that the BEA Comet 4Bs which are being used for night flying are less noisy than many of the propeller airliners which have always been flown at night."

"Rubbish!"

"It is true."

● Now that KLM have introduced their new styling *The Flying Dutchman* has become a phantom of the sky as well as of the sea. Imagine what Wagner would have made of this—the frenzy of sound and fury as a spectral Fokker is overhauled by a BEAtnik Vanguard on the night run to Amsterdam.

● It's Sky Bolt, not Skybolt. I am delighted to confirm that the name of this air-launched ballistic missile project should be written as two words. A *Flight* colleague secured this vital information from Donald Douglas Jr himself at the Douglas plant at Santa Monica the other week.

● Parliamentarian to technician:—"People keep talking about VTOL and I don't understand it. Tell me what it is." Technician explains all about vertical jet lift and how you slowly rotate the engines into the horizontal and eventually fly forwards with forward thrust, etc.

Parliamentarian: "Ah, now I understand and can discuss this intelligently in the House. And, of course, when you want to come down again you turn the engines right over to thrust downwards."

British salesman (thinks): "How on earth can we sell aeroplanes to people like this?"

US salesman (thinks): "What a wonderful potential customer."

● Most original argument yet for not building the Channel tunnel—"It has no export value."

The author? Christopher Cockerell, designer of the Hovercraft.

● "It is surprising how difficult this problem is [development of a collision-avoidance system] when one considers the effectiveness of missile-guidance systems currently being produced for the opposite function."

"The ATC problem is one of those things, like the selection of air hostesses, on which we are all experts."—Two quotes from J. E. D. Williams' recent *Flight* articles.

ROGER BACON

THE INDUSTRY

Towering over the tail of a BEA Comet 4B is one of four new multi-level maintenance platforms delivered to the corporation by Mercury Airfield Equipment, of Gloucester. It has a load capacity of 1,000lb and is adjustable from 7ft to 35ft. Primary adjustment is by hydraulic hand-pump from the middle platform; secondary setting is from the top platform. The swivelling upper stairway is vertically adjustable through an angular range of from 0° to 80°. Later models will be power-operated by push-button from the top platform

Ultra Celebration

ON Wednesday of last week Ultra Electronics Ltd celebrated the completion of one million passenger-carrying hours by Bristol Britannias, whose Proteus powerplants are equipped with the Ultra electric throttle-control system. The occasion was appropriately marked by inviting 90-odd guests, from the industry and Government departments, to travel in a chartered BOAC Britannia from London Airport to Filton, where, at the Bristol Siddeley works, they were able to watch Proteus engines on test and see the control in actual operation. At a luncheon in Bristol the visitors were welcomed by E. E. Rosen, chairman of Ultra Electric Holdings Ltd; and Air Chief Marshal Sir Alec Coryton, joint deputy chairman of Bristol Siddeley Engines, also spoke.

Originally developed for the Proteus, and now available for general turbojet and turboprop application, the Ultra throttle control system utilizes international standard synchros and a.c. servo-motors in conjunction with magnetic amplifiers.

Depending on the torque required, the equipment consists of either two or three units. The pilot's power lever is mechanically connected by a short push-rod to a transmitter unit which passes the necessary position information to an amplifier, which may be located at any convenient position in the aircraft, or alternatively may be combined as a single unit with the transmitter, thus simplifying the cable runs.

The amplifier in turn feeds a signal to a servo-motor unit mounted on the powerplant and directly controlling the throttle valve through the full range from maximum power to ground idling or maximum reverse. An override or emergency control is also provided, and can be brought in by a selector switch on the console. On override, a separate inching switch controls the throttle, the motor being energized from the aircraft stand-by 28V battery supply (normal operation is from the 115V d.c. supply). A warning light can be provided in the instrument panel to indicate cable or power failure; in such an event the throttle setting at the moment of failure is automatically retained.

Advantages claimed for the system include: positioning sensitivity (0.2 per cent of full throttle travel) ensuring accurate control and with negligible backlash; accurate positioning against widely varying load torques; and a linear response, unaffected by ambient temperature, altitude or structure-flexing effects.

In conclusion, it is appropriate to quote here a passage from John L. Edwards' article on "The First Supersonic Turbojet" in *Flight* last week: "Nevertheless, the electrical system must replace the hydro-mechanical within the next few years. It did so many years ago on the Bristol Siddeley Proteus (Ultra) . . ."

Integration and the Engineer

SOME of the benefits of integration were expounded by Lord Nelson of Stafford, chairman of the English Electric Co Ltd, when he presented awards to Vickers-Armstrongs (Aircraft) Ltd apprentices at Weybridge on Monday last week. He said that engineering development brought great benefit to people all over the world, and to become an engineer offered both personal satisfaction for the service of mankind and expanding opportunities for responsibility. Referring to the new Bristol/English Electric/Vickers Group, Lord Nelson said that the industry's new streamlined structure would ensure the avoidance of duplication in research—which was the key in an industry of increasing capacity, where the requirement was for successful commercial endeavour. English Electric spent £12m a year on fundamental research and the benefits of this would now be available to the common pool.

Lord Nelson was accompanied on the platform by the chairmen of the other parent companies, Lord Knollys of Vickers and Sir Reginald Verdon Smith of Bristol Aircraft, and also by six other directors of the parent or constituent companies from which the British Aircraft Corporation has been created. This newly constituted body was described by Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft) Ltd, as "having some substance."

The company's education officer, E. G. Barber, said in his review of the year's work (August 1958-August 1959) that a difficult period in pre-merger days had been successfully tackled. Apprentice intake had been reduced in the year under review, but now had substantially increased. In his report on the Apprentice Association its chairman, apprentice A. Carter, said among extended activities planned were the design of a man-powered aircraft which it was later hoped to build, and another for a four-seater light aircraft.

IN BRIEF

The Dowty Group's exhibits at the British Trade Fair in New York (June 10-26) will include Avro Vulcan and Fokker Friendship main undercarriages, a Viscount propeller and a sectioned fuel system for the Gyron Junior.

We regret to learn of the death of R. P. Creagh, one of the directors of Simms Motor & Electronics Corporation Ltd, of London N2. Mr Creagh, who was 70 years of age, was an early flying enthusiast and obtained a pilot's licence at Brooklands before World War I.

Appointed executive directors of King Aircraft Corporation of Glasgow are J. N. Hosie, CA, ACWA, and J. M. Howard. Mr Hosie joined the company in 1957 as chief accountant and Mr Howard, who joined in 1948, was works manager for six years before transferring to the sales division; during the war he was a Transport Command pilot.

Honeywell Controls Ltd announce that F. J. Pearson, micro-switch branch sales manager at Birmingham, now has additional responsibility for sales and service in the machine-tool industry and that J. Lunn has been transferred from the Manchester branch to the head office at Greenford, Middx, to develop sales and service of new micro-switch products.

Intended primarily for the use of children in junior and secondary modern schools, a well-illustrated booklet entitled *The Story of Flight* has been issued by the educational section of the Dunlop Rubber Company's public relations department, 10-12 King Street, London SW1. It was produced with the co-operation of two well-known aircraft historians, Frank Smith and C. H. Gibbs-Smith.

Special-award winners at the Vickers-Armstrongs (Aircraft) Ltd speech day at Weybridge last week, reported above. In front of a Vanguard for TCA they are, from left to right, M. Harmer (best progress by a trade apprentice in the Apprentice Training School); J. Stillman (Pam Newton Memorial Trophy for the best trade apprentice); P. Drew (best progress by an engineer apprentice in the School); J. G. Hicks (Weeks Trophy for the outstanding apprentice of the year); B. E. Cox (best progress by an undergraduate apprentice in the School); and C. J. Speake (for contributing most to Apprentice Association activities.)

Power Supplies for Small Missiles

PART 2: PNEUMATIC, HYDRAULIC AND ELECTRICAL SYSTEMS

By J. B. BERK

PART 1 of this article, published last week and contributed by R. Mansey of de Havilland Propellers, dealt with the subject from an alternator engineer's viewpoint. The author of this second instalment is project engineer to (as it is now named) the Weapon Division of Fairey Engineering, which was responsible for the first successful British air-to-air guided weapon, Fireflash. Mr Berk was a senior member of the design team responsible for this weapon. Although no official statement has been made, it is understood that Fairey Engineering are now engaged on design and development of anti-tank guided weapons.

THE essential feature distinguishing a guided missile from other warlike projectiles is its ability to manœuvre during flight in response to guidance signals. This ability is derived either by movement of aerodynamic control surfaces or by deflection of the rocket exhaust gases. The auxiliary power supplies have to supply the energy to operate these controls and to energize the electrical circuitry of the missile. These two power requirements are frequently interdependent and may be fed from the same source. Power is also required to run the gyroscopes up to speed prior to launch, and this may be obtained from an external source.

Over the range of small missiles, electrical energy is consumed at a rate varying from a few tens of watts to a few hundred watts, and the mechanical power for manœuvre control varies from a fraction of a horsepower to approximately three horsepower. As the flight times are usually much less than a minute, it can be seen that the amount of energy required to be stored is not very large.

The basic energy sources that are available for missile use include electric batteries, compressed air or nitrogen, cordite or liquid fuels, and high-pressure gases from the rocket motor (provided the motor charge burns throughout the flight). Liquid-fuel systems can supply high powers for long durations, and are therefore more suited to larger missiles.

Control Power. Guided missiles with aerodynamic control surfaces may be controlled either by moving the surfaces in proportion to the guidance demands or by oscillating them between fixed stops on either side of centre and altering the dwell time in either direction. Proportional control, which is superior in many respects to oscillating control, is usually associated with pneumatic or hydraulic surface actuation, whereas oscillating control readily lends itself to electromechanical means (for example, by the use of solenoids). Proportional electromechanical actuation is difficult to achieve with adequate response time, but nevertheless is within the bounds of possibility when the control forces are small.

Although details of rocket jet-deflection systems have not been revealed, it is probable that deflection of the jet is achieved by broadly similar means to control-surface actuation.

Pneumatic power. Where the control power required is not very great a pneumatic system offers many advantages. The system is simple and can be made very reliable using well-established techniques. In addition reasonably low weight and small size can be achieved.

In Fig 1 is seen a typical pneumatic control system, using a pressure vessel for air storage. The size of the pressure vessel is dependent upon the average flow-rate required, the duration of flight and the maximum pressure decided by design considerations. A nominal pressure of approximately 3,000lb/sq in is convenient, as it allows charging from standard commercial air or nitrogen cylinders, although higher pressures are used where such a system would be too bulky.

At about the moment of firing the compressed gas is released instantaneously by an electrically operated stop-cock, and it then passes through a reducing valve which maintains a constant outlet pressure for the average flow-rate. This working pressure usually lies between 100 and 400lb/sq in.

The gas at the reduced pressure is then passed to the control-surface actuators. Each actuator is controlled by an electropneumatic valve, which alters the differential pressure in a pair of cylinders according to the guidance demands. The control surface is attached by mechanical linkages to a piston in each cylinder, so that the surface position is governed by the relative position of the pistons. The gas flows continuously through the electropneumatic valve and out of the missile as a total-loss system, and control of the valve is achieved from the output of a transistor or thermionic-valve amplifier operating the coils of the electropneumatic valve.

As an alternative to using compressed gas stored in the missile a pneumatic system can, for small powers, be pressurized by ram air from an intake on the missile body. This will increase the missile drag and the design must allow for climatic changes, variations in air density and missile speed and also for the effects of different missile attitudes on the efficiency of the intake.

Specially designed pneumatic actuators can be operated by compressed gas piped from the rocket motor, provided burning is sustained throughout flight. Alternatively the compressed gas can be obtained from a separate slow-burning cordite charge, contained in a pressure vessel and ignited at launch. This system involves difficult problems in the provision of adequate filtration of the gas and in the design of hot-gas actuators, but a successful design can produce a compact and lightweight installation—particularly if gas from the rocket motor can be used.

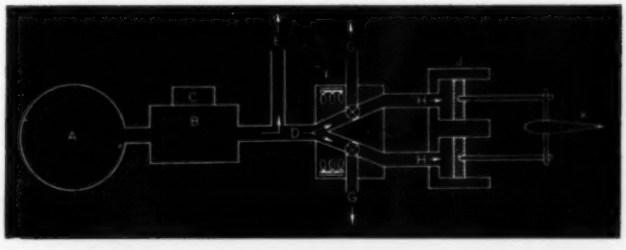
Hydraulic power. In general, hydraulic systems are more favoured in large missiles where higher powers are required to operate the control surfaces. In small missiles hydraulic systems tend to be heavier than equivalent pneumatic systems, but nevertheless may be preferred for other reasons. Hydraulic systems fall into two main categories: the total-loss system, where pressurized hydraulic fluid passes through an electrohydraulic valve and out of the missile, in a similar manner to the pneumatic systems already described; and the circulating system, where fluid is pumped round a closed circuit through the electrohydraulic valve. These systems are shown diagrammatically in Figs 2 and 3.

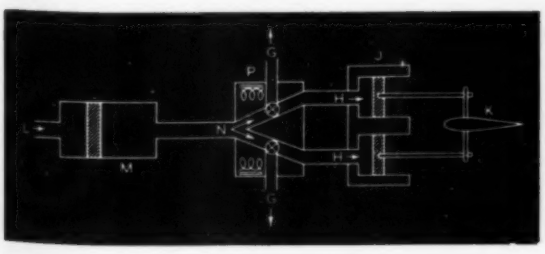
Fig 1 (right). Schematic diagram of pneumatic system

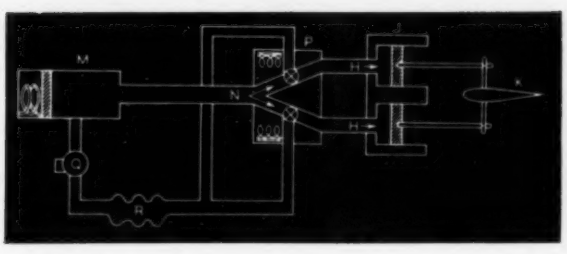
Fig 2 (below, left). Total-loss hydraulic system

Fig 3 (below, right). Circulating hydraulic system

A, pressure vessel; B, reducing valve; C, electropneumatic stop-cock; D, gas-flow at constant reduced pressure; E, flow to auxiliaries; F, electropneumatic valves; G, exhaust; H, controlled differential pressure; J, actuator; K, control surface; L, pressure-gas inlet; M, hydraulic actuator; N, pressurized fluid; P, electrohydraulic valves; Q, pump; R, reservoir.







Power Supplies for Small Missiles . . .

In a total-loss system it is obviously uneconomical in weight to pressurize the hydraulic fluid by compressed gas stored in the missile; but, for short durations where the initial weight of fluid is small, it can be pressurized by a slow-burning cordite charge, or preferably by a bleed from the rocket motor, with reasonable weight economy. A circulating system may have a particular advantage, if the pump is electrically driven, in that all the missile auxiliary power can be derived from a compact electric battery. However, the system must be assessed in relation to equivalent pneumatic systems to determine which best suits the particular application.

In both pneumatic and hydraulic application adequate filtration is essential to avoid clogging the system, and very fine filters are standard parts of the various components. Also, filtration during charging has to be carefully observed.

A major factor affecting the design of the component parts is the environment that the missile has to experience. All parts of a pneumatic or hydraulic system can be designed without exceptional difficulty to meet with high reliability flight and transport vibration specifications and the temperature environment.

Special cases arise depending upon the role of the missile and the type of system used. For instance, an air-fired missile can usually be kept warm while the aircraft is flying, whereas a ground-fired missile may have to operate in extreme arctic and tropical conditions, when heating or cooling of the required magnitude is not easily achieved. Hydraulic systems must therefore be designed to allow for fluid expansion and contraction and for adequate actuator response over the relevant viscosity range. In addition, heating caused by the work done on the fluid, or by the use of high-temperature gas, has to be allowed for. The environmental temperature range has little effect on the operation of the components in a pneumatic system, but the pressure vessel must be designed to provide adequate flight endurance at the lowest temperature and to have adequate strength for the much higher pressures that develop at the higher temperatures.

It is obviously undesirable for hydraulic or pneumatic systems to leak. Loss of working fluid means topping-up, which is operationally undesirable—particularly if the missile has to remain in a ready-to-use condition for a protracted period.

Electric power. For small-missile applications electric power is derived either from batteries, from a turbo-alternator driven from the missile pneumatic system or from a slow-burning cordite charge. The choice between these supplies depends mainly on the type of components used in the missile.

Miniature secondary cells have been developed specially for missile application, and can be obtained in standard low-voltage battery packs giving high, medium or low current outputs depending on size. A typical medium-size silver/zinc alkaline battery can provide 60A at 12V or 120A at 6V for three minutes, the volume being less than 25 cu in. A battery of this sort can adequately provide both l-t. and h-t. supplies for a large number of thermionic valves, current for the valve heaters being obtained directly from the battery and the h-t. and bias supplies via transistor oscillators and associated rectifiers and voltage stabilizers. Frequently, transistors can advantageously be used in place of valves. Transistor circuits normally consume about one-twentieth of the power required for equivalent valve circuits; furthermore, low-voltage supplies only are required.

Dry Leclanché primary cells built into compact h-t. batteries can be used for thermionic-valve circuits when the lead is small, but h-t. will still have to be provided by a secondary-cell battery. Undoubtedly batteries provide the most suitable power supply for transistor circuits. Secondary or primary cells can be used, but the secondary-cell battery will in most cases be lighter in weight and will certainly provide a better-regulated supply.

Shelf-life of the batteries considered so far is inferior to that of the other components in the missile. Dry batteries have a shelf-life of several months in missile applications. Secondary cells have good shelf-life when stored without electrolyte, but when filled require periodic recharging and replacing. A further difficulty experienced with these batteries is their poor performance at low temperatures. This is not necessarily a great disadvantage in air-fired missiles which can draw hot air from the aircraft engines. Ground-fired missiles may require a small amount of power from the launcher to heat the battery. This is undesirable, because ground-fired missiles are expected to remain ready for instant use for lengthy periods, and ideally should require power only a second or two prior to launch. Batteries capable of meeting the full environmental specification for guided missiles, as well as having long shelf life, are, however, in an advanced stage of development.

Turbo-alternator power packs can satisfy the missile environmental requirements, including operation at high and low temperatures, and they have excellent shelf life. They are considerably heavier than equivalent battery supplies, but for outputs in excess of about 200W a cordite-driven turbo-alternator may be attractive, particularly when shelf life and low-temperature operation are of especial importance.

A turbo-alternator driven from the pneumatic system is frequently used in small missiles requiring a substantial amount of a.c. power regulated in frequency to about one per cent accuracy. This is achieved by means of an electropneumatic valve in the input line to the turbine controlled by the alternator output via frequency-sensitive networks. Voltage control to the same order of accuracy can also be achieved, and a d.c. supply is then obtained via transformers and rectifiers. Both types of turbo-alternator can deliver correctly controlled power approximately one second after initiation.

Gyroscope Power Requirements. The missile gyroscopes need to be run up to speed prior to launch. Air-fired gyros can be powered from the pneumatic or electric services of the parent aircraft. Pneumatic operation is obtained by blowing the air over small buckets cut into the periphery of the gyro wheel, and electric operation is usually obtained by running the wheel as part of a synchronous motor. The gyroscope may therefore be running from aircraft take-off until the missile is fired.

On the other hand, gyroscopes in ground-fired missiles require quick run-up devices to operate just prior to launch. This can be achieved by means of a high-pressure air blast from a bottle on the launcher, or the required energy may be stored in the missile. In the latter case the gyro can be quick-started by the missile pneumatic system, by a small inbuilt gas cylinder or cordite charge or by a wound-up spring. A quick-start device will generally run the wheel up to speed in less than 0.1sec. Owing to the short flight times of small missiles the gyro wheels usually coast during flight, but if r.p.m have to be maintained this can readily be done pneumatically or electrically.

Conclusions. For small missiles, pneumatic control-surface actuation is generally preferred at the present time and the component parts are in a highly developed state. Future trends may favour either hot-gas actuation using the rocket motor or electromechanical actuation. Both are attractive as they do not require pneumatic storage, but considerable research and development must be carried out before their advantages can be properly assessed.

Electric power supplies are also well advanced in development, and battery supplies are usually more attractive than turbo-alternators. However, where batteries are used, the ready-to-use shelf life of the missile would at present appear to be governed primarily by these components.

With the introduction of silicon transistors a major breakthrough towards the ideal small missile has been achieved. Such a missile may be broadly defined as having a shelf life measured in years without the need for periodic component changing or topping-up at specified intervals. It should be able to operate without heating or cooling in extreme arctic and tropical conditions, the latter with full solar radiation. It should not require any power supplies until a second or two prior to launch, and the total activation time should be no more than two seconds under all conditions.

It is obvious that a battery to fit this specification is now the key to the ideal small missile—and, as already stated, is in an advanced stage of development. In all other respects the specification can certainly be met in the foreseeable future using existing techniques.

EQUIPMENT SALES ABROAD

SINCE 1946 some £24m worth of aircraft equipment has been exported to over a hundred countries by three companies, Ferranti Ltd, Rotax Ltd and the Dunlop Rubber Co Ltd. Rotax have exported more than £6m worth of actuators, ignition, starting and generating equipment, switch gear and other items to more than 50 countries in Australasia, Africa, the Far East, North, Central and South America and the Middle East and Europe. Rotax equipment is fitted to 16 different types of overseas aircraft and seven types of British aircraft manufactured by companies abroad under licence agreements.

Ferranti artificial horizons, airborne fire control and airborne secondary radar equipment worth nearly £6m have been sold to 38 foreign countries and fitted to 11 different types of aircraft built overseas.

The same export pattern is followed by Dunlop tyres, wheels, brakes and operating equipment as well as windscreen wipers and de-icing equipment. Since the war, these products have earned £12m and their annual sales (£1m in 1954, £1.8m in 1959) are still growing. Dunlop products have been fitted to 24 types of aircraft in a dozen countries.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Friendship, Herald and the RAAF

WE read Stanley Brogden's article "What will the RAAF buy?" (April 1) with very great interest. The statement, however, that the RAAF values the Handley Page Herald's merits higher than those of the Friendship is in our opinion not too firmly based upon the actual facts. Even if this is true, then it certainly cannot be based upon better long-range capabilities of the Herald.

Before giving our comments, we must stress that neither aircraft is designed for a long range like Port Darwin - Butterworth, a distance of about 2,300 n.m. A stage like this can only be flown when special measures have been taken, such as increase of the maximum take-off weight and extension of the present fuel-tank capacity.

Without entering into a complete payload-range comparison a few comments may make our point somewhat clearer. For the flight Port Darwin - Butterworth the Friendship would consume some 13,500lb of fuel under ISA+15°C, and still-air conditions at a cruising altitude of 20,000ft (the Friendship is certified for a cruising height of 25,000ft). A block-time of about 10hr would result for the Friendship.

From a Handley Page publication named *Herald Facts—No 1*, it is learned that for a stage-length of 443 n.m. the Herald's block-time will be 2hr 17min under ISA conditions, still-air. Under these conditions on this stage-length the Friendship will need a block-time of 1hr 54min, taking into account the same factors. This means the Herald's *block-speed is 87 per cent of that of the Friendship*.

Now, it may be assumed that the above ratio of 87 per cent will not alter appreciably on longer stage-lengths. Especially for a very-long-range flight, it may also be very well assumed that fuel consumption will be in the same proportion. As has been said above, for a stage-length of 2,300 n.m. the Friendship would consume 13,500lb of fuel; or, taking into account the above block-speed ratio, the Herald would require some 15,500lb. Block-time for the Herald would be 11½hr against 10hr for the Friendship.

According to *Herald News*, or Handley Page's Newsletter on the Herald of July 1959, the empty weight of the 38-seat Herald is specified at 23,000lb. A 38-seat Friendship 200-series would weigh about 22,300lb. So, if for comparative purposes only a 38-seater airliner is taken, this means:—

(a) For the Herald, empty weight+fuel for 2,300 n.m. still-air at ISA+15°C is 38,500lb or 500lb below the present maximum all-up weight.

(b) For the Friendship, empty weight+fuel for 2,300 n.m. still-air at ISA+15°C is 35,800lb, or 1,700lb below the present certified maximum all-up weight.

In order to make both aircraft effective for this sort of long-range flight, take-off weight increases would be necessary for both. The Herald, however, would need a higher increase than required for the Friendship for equal payload on long range, thereby further reducing performance as the Herald would have to operate at a higher weight-level.

The above comments, though probably not exact to the pound, illustrate our point that the statement in your article cannot be founded on the actual facts. The Herald would be the less suitable aircraft of the two for operation on distances as long as Port Darwin - Butterworth, because:—

(a) It has a higher empty weight than the Friendship.

(b) It has lower block-speeds or, in other words, a performance-standard clearly less than that of the Friendship.

So should the RAAF prefer the Herald (which as far as we know is not the case) then the preference cannot be on these grounds.

Schiphol, Amsterdam N.V. KONINKLIJKE NEDERLANDSE VLIEGTUIGENFABRIEK FOKKER

WHILE Stanley Brogden's comments on the Herald are generally as they should be in his review of RAAF needs, he has credited the aeroplane with the ability to fly Darwin - Butterworth non-stop with full payload. Although well able to fly such a leg (indeed, the Herald has three times crossed the South Atlantic, a distance equivalent to Darwin - Singapore), it would not, of course, carry its maximum payload. However, this journey will only occur infrequently, e.g., when a VIP requires a personal short-field aeroplane in Malaya and when the opportunity to use intermediate landing grounds is denied.

The Herald's block time for Darwin - Butterworth is 10hr 25min, cruising in still air at 20,000ft, a crew of three and various supernumeraries being carried besides sundry baggage and comprehensive radio equipment.

The RAAF's real need is for a reliable aeroplane with particularly good flying characteristics, the ability to operate from small unprepared strips and built to an outstanding engineering standard. On these points the Herald particularly scores. It has demonstrated this convincingly of late while flying its 150,000 miles of see-it-in-action tours of 47 countries.

Its handling characteristics are acknowledged to be first class. It can operate under 1959 BCARs at 39,000lb in temperatures up to ISA+30°C from grass strips, tyre pressure being only 58lb/sq in. Furthermore, the increased power of the RDa.7 in military form gives the Herald an even better performance.

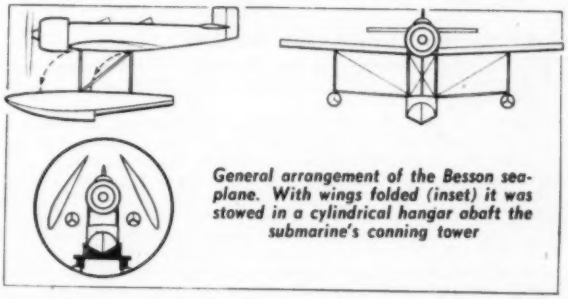
London NW2 S. A. H. SCUFFHAM,
Public Relations Manager, Handley Page Ltd

"Surcouf's" Seaplane

DURING the summer of 1958 there appeared in the correspondence columns of *Flight* (June 20 and July 25) a number of letters dealing with the identity of the small single-float reconnaissance seaplane carried aboard the French submarine *Surcouf* during the last war as part of her operational equipment, and which became airborne on test flights in Poole Harbour, Dorset, when the submarine arrived here after the fall of France.

After delving into the archives of the Service Historique de la Marine Française, and correspondence with the officer who was in charge of the seaplane until the time of his posting to St Pierre Miquelon on December 31, 1940, a M Suinat, the true identity of the aircraft has now come to light.

It was a Besson two-seat low-wing monoplane of wooden con-



General arrangement of the Besson seaplane. With wings folded (inset) it was stowed in a cylindrical hangar abaft the submarine's conning tower

struction which had a square-cut straight tapered wing and a large central float and two small auxiliary floats. It was powered by a radial air-cooled 170 h.p. Salmson engine, and the twin-bladed wooden airscrew was manufactured by Merville. Span was 19ft 8in and the length 16ft 4in approximately, and although the seaplane was built as a two-seater carrying pilot and radio operator, the latter could be dispensed with and the space made available utilized with an extra fuel tank to enable the range to be extended from 5hr to 7hr duration.

The markings and serial number borne by this aircraft are lost in the mists of time, and its ultimate fate is also unknown, but it must be presumed that the Besson perished when *Surcouf* sank in the Mediterranean in 1942.

Bournemouth, Hants K. S. WEST

Defence and a Merchant Air Service

MUCH attention has been focussed recently on defence policy, particularly on the nuclear weapon aspect of it. Deep emotions have been aroused on its account and although there is much anxiety in some quarters about our even possessing a nuclear weapon I feel most commonsense people must at heart be thankful that, however abhorrent the very thought of this hideous weapon may be, we now hold it as a deterrent. To the doubting I would ask simply—where, if threatened by the nuclear weapon (and this is today a grim possibility) would we be if we did not have it in our armoury?

But the nuclear weapon is not everything and we should not in possessing it fall into the trap of failing to protect ourselves as far as possible against any other foreseeable major threat. I have in mind particularly the danger of starvation. It is a fact, maybe too readily forgotten, that in both the last major wars we were very nearly humbled by this threat, to which we as an island continue to be particularly susceptible. A possible enemy would appear to be fully alive to this if the size and power of the submarine fleet which he is known to be building is any indication of his way of thinking.

While we must depend on the sea for our main supplies it seems a little surprising that having regard to the lessons we have learnt (or should have learnt) of the value and potential of air transport, with its easy ability to by-pass the submarine, so little attention appears to have been paid in the Defence Estimates and debates to the need for an air transport fleet to help in maintaining a flow of essential wartime supplies to and from our shores. As the Royal

CORRESPONDENCE . . .

Navy is required to protect the Merchant Navy in wartime so, I would have thought, a strong and powerful Merchant Air Service, with the accent on heavy long-distance freighters, is also needed to support it then and to relieve it where possible of some of its heavy responsibilities by bringing in supplies by the "new route" with its immunity from the torpedo. The starvation threat is clearly acknowledged in the Defence Estimates; then, surely, the ability of air transport to counter it, in some part at least, should not entirely be ignored, as would seem to be the present case.

It may appear that, in an age overshadowed by the nuclear weapon and its threat, I have unduly stressed the starvation one. Here I would argue that a foreign power is known to be building two powerful weapons with which he could possibly attack us, one from the air and the other on the high seas. There will clearly be no need to employ the sea weapon if he annihilates from the air first. But we may quite confidently presume he is not spending vast sums of money on the submarine, an offensive weapon if there was one, just for the fun of it. It would, then, not altogether be unreasonable to assume that sea attack is the one which he would first try out, nursing the nuclear weapon as a peacetime bargaining power (as we shall no doubt do, too) and using it only offensively—because of his full awareness of probable retaliation and its grim consequences to him—as a last desperate throw.

There are other arguments against the use of the nuclear weapon, initially at any rate, but space forbids.

London SW1 S. D. MACDONALD,
Air Vice-Marshal, RAF(Retd.)

"Air Convoy" Future for the RAF?

TO the dispassionate onlooker, unplagued by subjective and emotional influences, the future of the RAF as at present constituted is clearly in jeopardy.

Sooner or later, but probably during the present decade, the strategic bomber will become too vulnerable (even as a launching platform for stand-off bombs) for further war employment and will be finally displaced by the surface-to-surface ballistic missile—an artillery weapon, whether launched from a land or mobile sea base, and operationally nothing whatever to do with aviation. The fighter will then cease to have reason for continued existence.

If there should still be a need for long-range, shore-based maritime aircraft these should become an integral part of the Royal Navy. Sea power is truly indivisible; air power is not; and the dogma which argues the contrary, founded on the concept of flexibility in the sense of aircraft interchangeability, has become invalid with specialization of function. No one, surely, believes today that would be feasible to lend Coastal Command aircraft to Bomber Command for raids into the heart of Russia or, conversely, that V-bombers are capable of hunting submarines? At sea, tactical strike aircraft rightly belong to the Navy; likewise on land they ought to belong to the Army. Air transport is the proper function of civil aviation and should follow the age-old and well-proven maritime precedent; only direct tactical supply and support of the Army in battle should be a military function and should be performed, together with the tactical strike requirement, by an expanded Army Air Corps.

At first sight this leaves the RAF without any *raison d'être* and it is clear that sentiment alone would not justify the continued existence of a third fighting Service with all its attendant complexities and astronomic, ever-increasing cost. One contingency, however, seems to have been overlooked, at least insofar as any material provision for it is discernible. This is the protection of air transport in war, which may prove no less vital to our survival than the protection of merchant shipping. Just as the latter is by far the most important task of the Royal Navy so, in future, may be the former of the RAF. Moreover, the problems of defending transport vehicles which operate in three dimensions are basically more complex and difficult than those concerned with the two dimensions of the surface of the sea. So there is likely to be plenty of scope for an independent air arm in discharging this duty alone. As its other limbs wither, the defence of air transport may prove the justification and salvation of the RAF.

Except over friendly territory, where the air space should prove untenable to hostile aviation on account of surface-to-air missiles, the cornerstone of air transport defence must, as at sea, be the convoy system, for electronic detection methods are likely to make independent routing too dangerous. It is therefore upon the development of suitable aircraft and weapons for air convoy escort and the techniques for their employment that the RAF should now concentrate its energies and skill.

A host of new problems will have to be tackled, for transport aircraft have a variety both of optimum cruising speeds and cruising heights, from which they can depart only at the cost of grave and usually unacceptable reductions in range and endurance. They will have to be grouped accordingly and a whole family of escort aircraft will have to be developed, each of whose members will conform with one of the groups in cruising speed, operating height, range and endurance. In addition to a heavy fuel load escorts will have to carry powerful warning radar; an armament of air-to-air missiles with comprehensive electronic gear for their direction and for the jamming of hostile missile-directing transmissions; and, lastly, a sizeable fighting aircrew with the amenities requisite for efficient existence.

It is therefore apparent that the old concept of the long-range escort fighter as a small single- or two-seater, highly manœuvrable gun platform, not very dissimilar from the intercepter fighter, is dead. The aircraft now required is very much larger; a high degree of manœuvrability cannot therefore be incorporated and in any case has no merit in the air-to-air missile age. Indeed it seems probable that the air convoy escort of the future will have an airframe and engines basically similar to those of its charges and may even, initially, at any rate, be a converted transport aircraft of the same type.

This will ease a number of difficulties in the early stages of development and would also help to solve the current problem of what to do with the glut of piston-engined airliners made obsolete by the jet age though far from being worn out.

Southsea, Hants F. P. U. CROKER,
Lt Cdr RN(Retd)

Russian History Rectified

OUR Soviet friend E. Meos (Correspondence, April 8) will, I think, find that the first powered aeroplane flight "over Russian soil" took place long before Efimov learnt to fly (January 1910), let alone before he flew there in March 1910. The first "hop-flight" (80 metres) in Russia took place at Odessa on July 25, 1909, when M. Van den Schkrouff (*sic*) took off in a standard side-curtained Voisin bought by the Odessa Aero Club. On August 24 of the same year Cattaneo did a respectable 15km at Odessa on the same machine, but crashed mildly on landing. Georges Legagneux made at least two flights on his Voisin at Moscow (one of them on September 27), and I believe Guyot flew at St Petersburg in November.

Efimov was a fine pilot and did excellently at Nice in 1910, but I think Mr Meos is inflating his hero a little when he talks about first international records, and so on. For 1908 and 1909 we all accept the record "homologations" of the Aéro Club de France and the Commission Aérienne Mixte; the FIA only came into its own in this record business as flying spread. Incidentally, Efimov's record in January 1910 (it was January 31, by the way, not January 30, to be pedantic) was only "half" a record. On that day both Efimov and Van den Born took up a passenger at Châlons in a Henri Farman biplane. Van den Born covered 93.77 miles in 1hr 48min 50sec; and Efimov covered 98.11 miles, but in the shorter time of 1hr 48min 30sec. Both were, however, short-lived records, as Daniel Kinet (also on a H. Farman) stayed up with a passenger for 2hr 19min 15sec at Mourmelon, on April 8.

Comrade Efimov certainly whizzed about the place: Mr Meos says he was in Odessa on March 30, 1910. Yet on Saturday, April 2, he was certainly testing his new Henri Farman (of which he had just taken delivery) at Châlons; on the next day, Sunday of all days, he was giving rides to two girl friends at Châlons (I can even give Mr Meos their names if he promises to be discreet). The Nice meeting started on April 10. In return for the ladies' names I should be grateful for the actual date when Efimov took command of the Russian Volunteer Air Fleet: I think it was October-November 1910.

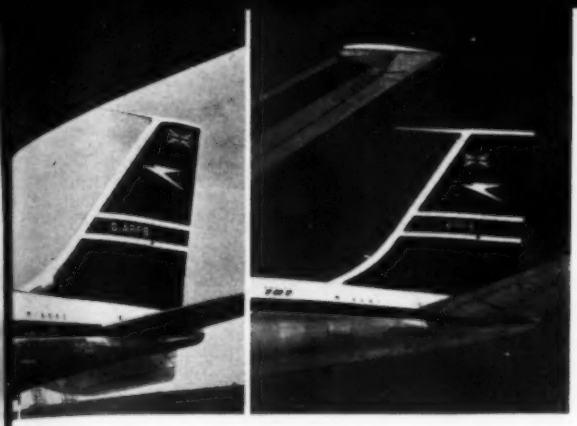
London W1 CHARLES H. GIBBS-SMITH

P.S. On second thoughts I will be indiscreet now, in anticipation. The girls were the Mesdemoiselles (or Mesdames) Bird and Frank.

FORTHCOMING EVENTS

May 3-13. Mechanical Handling Exhibition, Earls Court, London.
May 6-8. Shackleton Sales Weekend, Kidlington, Oxon.
May 9-11. Institute of Welding: Spring Meeting.
May 11. RAeS: Second Halford Memorial Lecture (at Hatfield), "Powerplants for Supersonic Transports," by J. S. Alford.
May 11. British Institution of Radio Engineers (Radar Group): "Radio Guidance in the Automatic Landing of Aircraft," by J. Shayler.
May 11. Kronfeld Club: "Around the USA," second of two lectures by John Furlong.
May 12. RAeS Astronautics and Guided Flight Section: "On Reducing Costs of Space Research," by J. E. Allen.
May 13-15. Channel Islands Aero Club: International Rally, Jersey Airport.
May 14-15. Verona Aero Club Rally.
May 17. RAeS Historical Group: "My First Ten Years," by Sir Thomas Sopwith.
May 19. RAeS: 48th Wilbur Wright Memorial Lecture, "Mathematics and Aeronautics," by Prof M. J. Lighthill.
May 20-21. RAeC: Business and Touring Aircraft Competition, Shoreham Airport.
May 22. Elstree Flying Club: Breakfast Patrol.
May 28-29. Skegness Aero Club: International Rally.
May 28. Northern School of Aviation Flying Club; At Home and Flying Meeting, Squires Gate, Blackpool.

RAeS Branch Fixtures (to May 13): May 11, Chester, a.g.m. and Film Show.



New tail-feathers for old, and a higher-flying Union flag: on the extreme left is the vertical surface area of BOAC's 707-420 after modification by Boeing at ARB request. The extent of the alteration —a 3ft 1in taller fin and a ventral fin—may be gauged by reference to the original fin of the same aircraft, G-APFB (right), photographed from roughly the same angle five months ago. BOAC took delivery of their first 707, G-APFD, at London Airport on April 29. It was flown non-stop from Seattle by Capt Tom Stoney, 4,900 miles in 9hr 44min. The ARB issued the C of A on April 28

AIR COMMERCE

BOAC CHOOSE AVRO

WHEN Sir George Cribbet, performing one of his last duties as chairman of BOAC Associated Companies, signed last week for three Avro 748 Series 2s (Rolls-Royce Dart RDa.7) for Aden Airways, he suggested that other BOAC associates might be in the market for this aircraft.

Which BOAC associated companies may in fact be interested? Those with DC-3s are as follows (Aden Airways excluded): Bahamas Airways, who have three (80 per cent ownership of the airline now being in the hands of David Brown and Eric Rylands, whose UK airline Skyways has three 748s on order); BWIA, four (this operator is unlikely to remain a BOAC associate with Federation independence next year); Malayan Airways, ten; and MEA, four. There are thus four BOAC associates which, owning a score of DC-3s, might be considered as potential Avro 748 customers.

Value of the Aden Airways contract is given as about £800,000; because the price of a completely equipped 748 Series 2 is about £225,000 the Aden Airways contract appears to allow for about 15 per cent spares.* Deliveries are scheduled "for the summer of 1962." Among the competing aircraft studied, it is stated, were the D.H.123 (a twin-Gnome, 30-seat high-wing paper project with aircraft-mile costs reportedly claimed to be lower than those of a written down DC-3), the Dart Herald and the Friendship.

The Series 2 RDa.7 version of the 748 chosen by Aden Airways (see *Flight*, April 22) will permit operation under the prevailing hotter-and-higher airfield conditions of the airline's network.

The significance of the order is perhaps best summed up in a remark of Hawker Siddeley Aviation's joint managing director, J. A. R. Kay: "It is particularly encouraging to feel that the 748 now has the support of one of our national airline corporations."

The prototype 748 is some weeks behind its original first-flight schedule of February 1960; the maiden flight is expected to take place later this month.

AN IDEA FOR THE SIX-POOL

NOT a great deal of scope is left for air services on British domestic routes when trunk and holiday needs have been satisfied. The gaps are filled in on a seasonal, supply-and-demand basis without much thought for prestige services or co-ordination. This is a fruitful field for exploration by the proposed six-pool partnership of British independents and it gives new life to a Bow Group suggestion for co-ordination on some domestic air services.

The idea is to operate a businessman's weekday service between six major British towns between the hours of 6 and 10.30 p.m., providing a useful facility and—by extending the airline's domestic working day—offering potential profit to its operators. The towns that it is suggested should be served include Liverpool, Manchester, Birmingham, Newcastle, Leeds, Cardiff and Southend, and the successful operation of what the Group describe as "the business air travel scheme" depends upon collaboration between the independent operators and BEA.

In the Group's studies, conducted before the six-pool was announced, it was assumed that the airlines taking part in these essentially inter-seaport and perimeter (rather than radial-pattern) services might be BEA, BKS, Cambrian and Channel. The schedule proposed is as follows, and the Group have been at pains to point out that existing timetables—either rail or air—at present make impossible evening business journeys between these towns. A point to notice is that each service is out-and-return, with Birmingham as the hub from which onward connections are available. (This suggestion echoes an idea for a similar integrated service put forward by the Maybury committee shortly before the war.) It is suggested by the Group that the routes would be operated independently and not in pool, although revenue would be collated and distributed on a basis of scheduled time or on scheduled stage distance.

PROPOSED SCHEDULES

BEA	Liverpool	dp 18.15	ar 22.00
	Manchester	ar 18.40	dp 21.35
	Manchester	dp 19.00	ar 21.15
	Birmingham	ar 19.45	dp 20.30
BKS	Newcastle	dp 17.45	ar 22.30
	Leeds	ar 18.30	dp 21.45
	Leeds	dp 18.50	ar 21.25
	Birmingham	ar 19.45	dp 20.30
Cambrian	Cardiff	dp 18.20	ar 22.05
	Bristol	ar 18.40	dp 21.45
	Bristol	dp 19.00	ar 21.25
	Birmingham	ar 19.50	dp 20.35
Channel	Southend	dp 18.40	ar 21.35
	Birmingham	ar 19.40	dp 20.35

The co-ordination of services in this way might be accompanied by an integration of equipment eventually allowing a uniform type to be used profitably on domestic services. It has been proposed from time to time that operation of a new type might be arranged on a lease basis from a British holding company—the aircraft might be Dart Heralds or Avro 748s, both of whose sponsors have no doubt taken note of the fact that a Friendship is next week to be demonstrated at Gatwick.

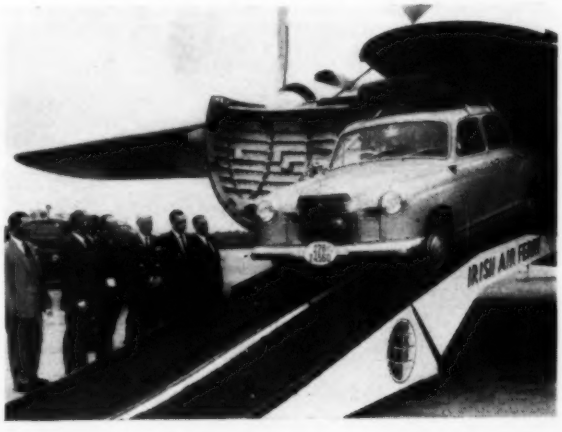
Profit from the integration scheme would be distributed after an assessment of traffic and revenue statistics by, the Bow Group suggest, a management committee. In the light of recent events, these ideas might be re-examined in the context of the six pool, with Starways, Jersey and Derby include for good measure.

DUTCH HOUSEKEEPING GUIDE

A VIOLINIST was once asked why he always played the same note: he replied that while other players were looking for perfection, he had found it. Perhaps this explains the unvarying quality of KLM's annual reports. The latest issue, covering the calendar year 1959, has recently been published and—as was noted in these columns last year—it provides a model against which most other reports can be judged.

In the case of KLM, this high quality reporting job is no mere

Monday, April 25, was the day on which BKS inaugurated the Irish air-ferry from Liverpool. Seen here at Dublin are (l to r) L. M. Carrol, department of transport and power; T. J. O'Driscoll, Irish tourist board; Erskine Childers, Minister for transport and power; C. J. Stevens, managing director, BKS; H. Spring, BKS; and M. K. O'Doherty, Irish tourist board. BKS are in the proposed six-pool: see this page.



Basic price of the 748 Series 2 is about £196,000; equipped price of the Series 1 (Dart RDa.6) is about £200,000, basic price of this first version being £176,000. All these prices are claimed to be substantially lower than those of the Dart Herald and Friendship.

AIR COMMERCE . . .

window-dressing; it reflects an organization which functions to standards of overall efficiency which are unusual outside North America. Despite the vicissitudes of recent years, KLM continues to make a profit, and again returned a 7 per cent dividend to its shareholders. Costs continued to fall, and last year came down to one guilder per available tonne-kilometre (equivalent to 33 pence per c.t-m.). Nevertheless, because of (a) falling revenue rates and (b) load factors in the mid-fifties rather than the 60 per cent which was typical until recently, the profit levels are now lower than was the case in the golden pre-turbine era. Last year's profit was 15 million guilders (£1.4 million) on total revenues of 545 million guilders (£52 million); 1956 saw a profit of 23 million guilders on revenues of 446 million guilders.

High load-factors on Finnair's Caravelles since services started last month have resulted in Helsinki Airport handling a record number of passengers. Competition on routes to Stockholm and Copenhagen is said to have been intense since the pool with SAS was broken on April 1

It is possible to pick out three principal reasons why KLM's cost level fell in 1959. In the first place, increasing use of turbine fuel led to a further fall in the unit cost of that item; secondly, high utilization rates (8hr daily in the case of their long-haul equipment, 4hr 20min in the case of Convairs and Viscounts); and, finally, lower depreciation charges. Unlike certain other airlines the last-named were honestly accounted. Indeed this should give KLM cause for pride, for the reduction arose because their Convair 340 fleet, purchased only five years ago, has been fully written off in the books. Few airlines are in the happy position of being able to join KLM in saying "the aircraft of the Lockheed L.1049E and 749, Convair 240 and 340, Douglas DC-6A/B, DC-6 and DC-3 types have been written down to residual value of ten per cent." Another point worth noting is that development costs are written off as they are incurred and not—as is the case with BOAC—shuffled off to some future period.

Looking ahead, the report strikes a cautious note over the effects of further falls in revenue rates. Obviously the industry as a whole is going to be squeezed between fares that tend to fall and costs that can only just be prevented from rising. This report suggests that if anybody gets through without sinking back into the red then it will be KLM.

AMERICA'S BUSIEST AIRPORTS

FIGURES recently published by the FAA help to keep those startling US aircraft movement statistics up to date. America's five busiest airports in the calendar year 1959 were Chicago Midway, Miami, Phoenix, Los Angeles and Washington. New York Idlewild was fifteenth (239,836 total movements) and the airport nearest in numbers handled to London Airport, Winston-Salem NC (129,610 total movements), was placed number 82.

Chicago Midway is the world's busiest airport. In 1959 a total of 431,600 movements were handled, 1.6 per cent of the US total. On its busiest day, the tower at Midway handled a total of 1,694 movements, or one every 51 seconds throughout the 24hr period.

At the end of an FAI-timed, 3hr 14min record-breaking flight from London Airport: the first of Olympic Airways' four Comet 4Bs at Athens after delivery by Capt P. Ioannidis on April 30. Services will start on May 18, and a second aircraft will arrive this month

Britain's second busiest airport was Southend, which handled 62,553 movements during 1959. Fort Smith in Arkansas handled slightly more, and ranked number 179 on the FAA register. The Agency say that 1959 was the sixth consecutive record year for aircraft operations and the total number of movements was 300,000 greater than in 1958.

BOAC CUTS DEFICIT TO £1m

PRELIMINARY figures suggest that BOAC and its associates made a loss in 1959-60 of about £1m. This deficit is £4m better than the deficit suffered in 1958-59.

The £1m deficit is due entirely to the loss incurred by BOAC Associated Companies Ltd of £1.1m, itself an improvement of £2m on the previous year. So the essential fact in so far as BOAC's staff are concerned (if not Parliament and the public, who have to take account of BOAC's investment in associates) is that the corporation made an operating profit of about £100,000 in the year just ended—though it will be interesting to see from the published accounts whether this is only a profit because the associates are paying more than their fair share of interest.

BOAC's interest payments for 1959-60 were very heavy indeed —of the order of £3.9m—a jump of £1m on the previous year, which in turn was a jump of £1m on the year before that. Only part of this £3.9m interest, i.e., the part paid on Treasury stock, can be regarded as the nationalized corporation's "guaranteed dividend." The major part of the £3.9m interest was paid on capital borrowed for the purchase of new equipment; it is this which accounts for the big £1m-a-year jumps, but it cannot be described as a dividend.

BOAC's accumulated deficit—£12.9m last year—now goes up, it is understood, to about £13.9m. This indicates that there were no "below-the-line" losses during the year, but it provides a measure of the need for the big efforts that BOAC is now making to put its housekeeping in order.

QANTAS TO LEAVE NEW GUINEA

SOON TAA and Ansett-ANA are to take over the Australia-New Guinea services operated by Qantas. TAA will also take over all the regional Qantas services within New Guinea and to Hollandia in Dutch New Guinea, Rabaul, and the Solomon Islands. Both operators will use DC-6Bs on the services from Australia to New Guinea, Sydney - Port Moresby being the main route. One of the reasons for TAA's acceptance of the recent rationalization of heavy equipment with Ansett-ANA was that TAA did not possess equipment suitable for the run to New Guinea. The two DC-6Bs which TAA secured under this charter exchange agreement are ideal for this purpose.

Qantas at present services 34 airports in New Guinea and operates Otters, DC-3s, and often DC-4s. Part of the Government's decision to take Qantas out of New Guinea is an anticipation of an agreement between TAA and Qantas that TAA will acquire all Qantas assets, including airport facilities and aircraft, within New Guinea. TAA, however, is not very keen on this, and there will be considerable discussion before the final details are agreed.

TAA is known to feel that the Friendship would be a highly suitable aircraft for the regional services to the Solomons, Rabaul and Hollandia. Equipment will depend on Government policy regarding standards. At present New Guinea is not regarded as part of Australia by the Department of Civil Aviation in regard to standards. If the DCA does in the near future impose mainland ideas on New Guinea services, TAA will not be able to operate DC-3s and Otters from some of the marginal and high altitude airfields.

The new policy will give New Guinea residents the benefit of competitive operation on a route that until now has been a Qantas monopoly. Inside New Guinea, Ansett-ANA will not be permitted to operate and the private-enterprise competitor for TAA within

the Territory will be Mandated Airlines. But R. M. Ansett has been making some strenuous take-over approaches to Mandated in recent months; Australian opinion is that he will eventually succeed, though he will pay heavily for the privilege. There are several other small operators in the Territory, but Mandated is the only one which will be a competitor for TAA. The Minister for Civil Aviation, Senator Paltridge, specified in his policy statement that steps would be taken to protect the interests of the small men.

New Guinea residents are already hoping that TAA will introduce Friendships on some of the longer internal services as well as the Hollandia and Solomon runs. Pressurized aircraft are badly needed on these tropical routes.

Footnote: It was announced on April 29 that Ansett-ANA have placed an order for an additional Friendship. The Ansett-owned total is now seven.

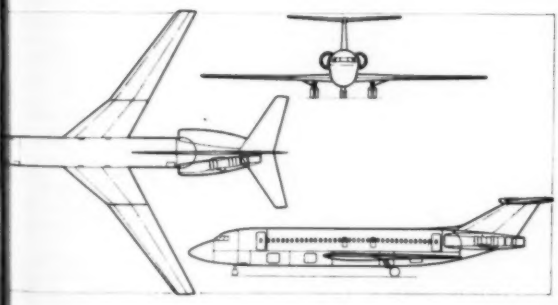
CONVERSIONS TO CARGO

TWO DC-7Cs of KLM are being converted by Douglas to DC-7F all-cargo configuration. The Dutch airline possesses 15 DC-7Cs. At the same time Panagra have delivered one DC-7B to Douglas for conversion to all-freight configuration. These new orders bring to 24 the number of passenger DC-7s being converted by Douglas. Each modification differs according to customer requirements, but the basic conversion comprises installation of large cargo doors; replacement of the entire floor and floor beam structure with new, heavier structure; removal of the windows; and installation of glass-fibre fuselage-wall lining.

In addition to Douglas, Lockheed Aircraft Service are undertaking conversions for other operators. The following table supersedes that published on these pages on March 4 last, and brings the cargo-conversion picture up to date:—

Type	Qty.	Conversion by	Approx cost	Date of order	Time-scale
DC-7C	10	Lockheed AS	£1m	Sept. 59	All in service
DC-7	6	Douglas	£1.73m	Jan. 59	First one delivered March, rest by December
DC-7B	15	Douglas	£1.5m	Jan. 59*	Five delivered by early March, 5 more this year
L1049C	5	Lockheed AS	£0.35m	Feb. 60	July/Aug. delivery
L1649A	2	Lockheed AS		Feb. 60	
L1049G	2	Lockheed AS	£0.1m	Sept. 59	
DC-7C	2	Douglas		Apr. 60	Work in hand
DC-7B	1	Douglas		Apr. 60	
L1049G	2	Lockheed AS		Jan. 60	
L749A	3	BOAC	?	Oct. 59	In service†

*Order for five more last month. †Plus one passenger version.



Above is a provisional general arrangement of West Germany's medium-jet HFB314, subject of a news paragraph on page 640

BWIA ARE ON THE ATLANTIC

SPECULATION about BWIA's transatlantic aspirations (*Flight*, April 15) was answered on April 29 by a brief announcement that the airline were to operate their first transatlantic services that night. They have arranged to charter Britannias from BOAC for a weekly London - Trinidad service via Barbados and New York (the latter a stop for which CAB approval has been given). A Britannia will leave London on Fridays and the returning aircraft will arrive on Mondays; BWIA's livery will be applied to the aircraft used, but they will be operated by BOAC crews.

So the West Indian flag carriers have embarked upon the first stage of a programme for becoming, with independence, long-haul operators in their own right. The decision to charter Britannias from their parent company may perhaps be taken as an indication that differences of opinion about the airline's future, both among BWIA's management and in West Indian political circles, are now on the way to being settled.

HARD "BERMUDA" BARGAINING

THE Americans are still determined to obtain Hong Kong rights for Northwest and they have not, it seems, compromised their other contentious argument that TWA should have "beyond rights" out of London. This is the essence of a BUP report from Washington as the UK-US negotiations on the Bermuda agreement are resumed there. Previous negotiations, it will be recalled, were adjourned after three weeks of largely unsuccessful discussions at Barbados from February 24-March 16.

The situation in this traffic-rights bargaining match is essentially that the Americans want more from the British than *vice versa*. What are we prepared to accept in return for granting Hong Kong to Northwest and "beyond rights" from London to TWA—adjustments to the Bermuda Agreement which BOAC (and also BEA in the case of TWA) have contested for so long?

The Caribbean problems have to some degree been settled and Pan American are now operating jets direct from New York to Jamaica, having been told to desist earlier this year.

The issues appear to be much the same as those reviewed when the Barbados meeting began ("From Bermuda to Barbados," *Flight*, February 26). One concession that the British negotiators could seek would be the limitation by PanAm and TWA of their frequencies on some of the routes where they compete with BEA and BOAC. But the Americans are fundamentally opposed to this sort of restrictive "capacity predetermination"—though they have such an agreement with India.

TOURISTS ARE BOOMING!

THE excellent *Digest of Tourist Statistics* published each year by the Board of Trade shows that, in 1959, 66 per cent of all American passport holders who visited Great Britain arrived by air. This was four per cent more than in 1958, but this is a paltry increase in comparison with the swing to air travel among those who are in transit through the UK. Most of these passengers stay in Great Britain for about three days and over the past three years their numbers have grown considerably; in 1957 there were three per cent more than the previous year, in 1958 the increase was 20 per cent and last year it was 29 per cent, all of it the result of air travel. Rather more than half these transitting passengers came from the United States and their growing numbers, suggests the *Digest*, reflects the growing importance of London Airport in international transit traffic.

In spite of the greater numbers of US travellers to visit these shores, still the majority of visitors came from Western Europe. There were 700,000 of them, and they helped to raise the total of overseas visitors to 1,400,000, 11 per cent more than in 1958.

Copenhagen's new airport extensions, which include a 10,000ft runway and new buildings, was opened last Saturday. The improvements, which represent an investment of £10m, include hydrant fuelling

AIR COMMERCE . . .

NEW HFB314 DATA

PERFORMANCE figures recently published for the Hamburger Flugzeugbau HFB314 show that—with two Rolls-Royce RB.141/3 engines—the average cruising speed at 36,000ft should be 590 m.p.h. Maximum cruising speed is said to be 610 m.p.h. at 23,000ft. CAR take-off runway length at maximum take-off weight is 5,250ft and landing distance at maximum landing weight (83,800lb), 5,050ft. The maximum payload of 10 tonnes can be carried 2,500 kilometres with no fuel reserves while maximum range, again with no fuel reserves, is about 4,400 kilometres. A payload of 10 tonnes can be carried over this distance.

Several alternative engines have been mentioned in connection with the HFB314, including a new variant of the RB.141. This is the 141/11, said to be rated for take-off at 15,500lb thrust. Other possible alternatives are two General Electric CJ-805-23s (16,100lb thrust each) or two P. & W. JT3D-3s (18,000lb).

ARGOSIES FOR ANSETT-ANA?

ANSETT-ANA are reported to be very interested in the Argosy. Hawker-Siddeley's local office has given the Australian operator a detailed study of routes and costs.

Ansett at present operate two DC-4s, three DC-3s and a Bristol Freighter as their all-freight fleet. TAA have introduced two DC-4 freighters in the last three months and also operate three DC-3 freighters. Roughly 63 per cent of all the freight carried in Australia is lifted in freighter aircraft. In 1959, advance figures from the Department of Civil Aviation show that Australia's domestic operators lifted about 72,000 tons. This is still 7,000 tons less than the peak year of 1953-4. This year both operators on the trunk routes have opened a big publicity campaign to attract freight. They expect to touch 80,000 tons in 1960.

Break-even on DC-3s, according to TAA figures, is about 75 per cent, and on DC-4s 50 per cent. The two operators are today averaging about 70 per cent overall. The DC-3s lost money on freight operations, but are phased into the overall picture.

Ton-mile freight charges on trunk routes today are about 46d. The Australian operators believe that if charges could be cut by 30-35 per cent, air freight would be trebled.

The CL-44 is being pushed very hard in Australia by the local Canadair office, but both operators are said to consider that £2 million is too great a price and that the aircraft is too big anyway. They want frequency rather than capacity at this stage. The Argosy is therefore quite in the picture (it would sell at well under £A500,000). Ansett-ANA could have a fleet of four or five Argosies for the cost of one CL-44 or Super Hercules.

LIABILITY FOR COLLISIONS

DRAFT rules relating to the liability of operators in the event of aerial collisions are now in the process of development, said Dr Gerald S. Fitzgerald in a talk delivered on April 15 to one of the "Aeronautical Fridays" meetings of the Centre for the Development of Air Transport in Rome.

Such rules have been under study for upwards of 30 years but have not yet been included in a definitive treaty on the subject. An ICAO sub-committee which met in Paris a month ago has drawn up the draft convention on the subject. This text will be considered by the ICAO Legal Committee later this year.

The speaker summarized the main provisions as follows:—

(1) The provisions of the convention shall apply when two or more aircraft in flight have collided or interfered with each other.

(2) The convention shall apply when two or more of the aircraft involved have the nationality of different contracting States, irrespective of where the collision or interference occurs.

(3) The convention shall also apply if the collision or interference occurs in the territory of any contracting State and at least one of the aircraft involved has the nationality of another contracting State.

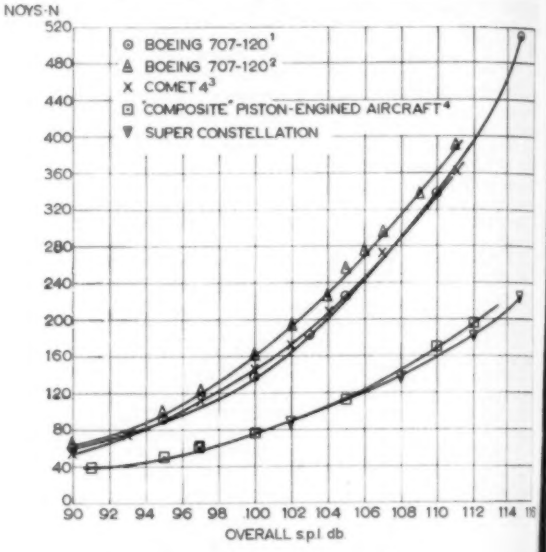
(4) Liability for damage shall attach to the operator whose fault must be proved by the claimant before the latter can recover.

(5) Provision shall be made for certain limitations of liability of the operator depending on the type of damage concerned.

(6) The proposed convention shall apply to military as well as to other State aircraft in addition to civil aircraft, although contracting parties may stipulate that they do not want the proposed rules to apply to aircraft of their State.

The speaker stressed that the draft convention was a most complex document which would require further definition.

Noisiness in noys (N) v. overall sound pressure level (db). (See "Curves of Truth" below). Notes: (1) full power 12,000lb wet thrust at 160kt; (2) 8,000lb reduced thrust; (3) 7,350 r.p.m. reduced thrust, 5,000-6,000lb; (4) average spectrum of DC-7, -7B, -7C, -6B, L.1049 and L.1649



CURVES OF TRUTH

BECAUSE it is agreed by everyone except the Minister of Aviation that decibels provide a false measure of jet v piston-engined aircraft *noisiness*, this graph has been prepared to enable a comparison to be made between the sound pressure and noisiness of jet- and piston-engined aircraft.

Anyone with a decibel-measuring device—i.e., a gauge recording sound pressure—can, by reference to these curves, read off directly the equivalent value in Ns (noys) of his db readings.

For example, a London Airport resident recently claimed that whilst in his garden he measured a 707 sound pressure level of 115db. From this graph he can see that the noisiness was no less than 500N. This compares with the 100N or so (97db) which the Minister considers reasonable.

All the figures that went into the plotting of this graph were derived from Bolt, Beranek and Newman's October 1958 report to the Port of New York Authority. For a summary of the essential information in that bulky two-volume report, reference can be made to *Flight* for November 7, 1958, page 743. An article *Noise in the Jet Age* in our issue of August 14 last set out the technical case for measuring jet noise in terms of Ns rather than db.

Which of these two different types . . .

FLIGHT RECORDERS FOR THE ELECTRA?

LAST Tuesday was the final date when US airlines could report to the FAA their views on that agency's proposal to make mandatory the installation of flight recorders in all turbine aircraft (*Flight*, April 15). Until then, flight recorders had been mandatory installations in aircraft cruising above 25,000ft, i.e., jet transports only.

The FAA's proposal followed the mysterious disintegration of the Northwest Electra near Tell City last month, and the proposed rules would require flight recorders to be fitted in all Electras (and, presumably, Viscounts). Had flight recorders been fitted in, and recovered from, the Northwest Electra—and from the Braniff Electra which disintegrated last year—there is no doubt that the present investigation might have been simplified. In its scale, expense and intensity the Electra investigation is reminiscent of that to which the Comet 1 was subjected.

The FAA proposal requires the fitting of an approved recorder capable of noting at least the five basic flight parameters—time, heading, airspeed, altitude and vertical g forces. They would have to be "installed and operating continuously during flight" in all turbine-powered transports of more than 12,500lb. [*News of an agreement for US marketing of a British flight recorder—Royston Instruments' Midas—appeared in last week's issue.*]

GOLDEN SUPERSONICS

MOST of the talk about supersonic airliners originates from the aircraft manufacturers; it is unprecedented to hear of an airline beckoning on the supersonic age. Possibly Continental Airlines, the carrier concerned, enjoys the distinction of being the first in the world officially to express warm feelings for supersonics. In his annual report for 1959, Robert Six, Continental's president, says:—

"We definitely believe that supersonic transports will supplement our present Boeing Golden Jet aircraft rather than replace them. We believe that our present jet aircraft will have a long and profitable service life. Supersonic aircraft will be relatively few in number, and their use by Continental will be limited to the longest haul routes where their extremely high speed will be of great advantage to the travelling public in time savings.

"Used in this manner, supersonic transports will be sound investments for the nation's airlines. While each transport will cost some two and one-half times as much as our subsonic jets, productivity will be more than three times greater. By 1967, we predict that supersonic airline transports will be flying Continental's passengers at a speed of Mach 3 or about 2,000 miles per hour. Such aircraft can be built, and United States manufacturers are capable of building them now. Your company presently has a team analysing designs of two manufacturers and is planning the many steps necessary to conduct supersonic operations. Our analyses show that such aircraft can be operated economically."

BREVITIES

Ekco Type E160 weather radar is to be installed in the two AWA Argosies ordered by Trans Arabia Airways.

Air Ceylon are to inaugurate their second international service, from Colombo to Canton and London, in October.

Recently issued by the FAA is a *Heliport Design Guide*. It is published by the Superintendent of Documents, Government Printing Office, Washington 25, DC, price 30 cents.

A new chairman of the CAB is shortly to be appointed by President Eisenhower. He is Whitney Gillilland, a lawyer, and he will replace James Durfee who is to become a federal claims court judge.

Approval has been granted to Dan-Air for the operation of scheduled services between Bristol and Liverpool and between Bristol and London (Gatwick) from April and October each year until October 31, 1966. The Bristol - London service will start this season on July 15.

The Allison turboprop Convair received FAA certification for commercial service on April 22. This followed a 15-month evaluation programme and flight testing extending over 345hr. Certificated maximum take-off weight is 53,200lb and at this weight minimum field length is 4,180ft. Orders have been placed for 16 aircraft.

From June 1 there is to be a price increase of 5 per cent on all models of the Douglas DC-8. This follows an increase from May 1 of the price of all 707s and 720s, by amounts varying between 4 and 6 per cent. Present price of the DC-8 is about $5m, and of the 707 not far short of $6m.

Ten of the 11 passengers and the pilot of a Lineas Aeropostal Venezolana DC-3 were killed on April 28 as a result of what was said to be the explosion of a bomb by a Russian citizen. The aircraft was on a scheduled flight between Caracas and Puerto Ayacucho and crashed near Calabozo in northern Venezuela. One passenger, the co-pilot and the stewardess survived.

An arrangement has been made between the Channel Air Bridge and the Automobile Association by which cars or motor cycles involved in accidents or with major mechanical defects will be railed to the Channel Air Bridge continental termini and flown home to Southend. The AA say that with the opening of the longer range routes to Lyons, Strasbourg and Dusseldorf, for which the Air Bridge have applied, the scheme will be extended in scope and will be used for the majority of cars returned to Britain by the AA under this scheme.

For the first time in its history Trans-Australia carried a million passengers over a 12-month period. The millionth travelled on April 20.

The first Il-18 has been delivered to Malev and was to start operations between Budapest and Moscow on May 1.

Ernest A. Cutrell, an authority on the all-weather operation of transport aircraft, has joined the staff of R. Dixon Speas Associates, Long Island, USA.

A retirement on May 1 was that of Senior Captain First Class Edward W. Jordan, OBE, manager of BEA Jersey flight for the past 12 years. The new manager is Captain Charles E. S. Riley, AFC.

A three-acre training centre at Heston is to be constructed for BEA by Holland & Hannen and Cubitts (Great Britain). It will cost £½m and should be completed by September next year.

Approval has been granted by the Ministry of Aviation to East Anglian Flying Services to operate between Ipswich, Southend, Rochester, Shoreham, Paris, until March 31, 1962.

Asked in the Commons whether he would now allow the corporation to compete freely with the independents in the trooping business, the Minister, Mr Duncan Sandys, said, "I see no reason to change the existing arrangements."

Air Nautic has recently purchased a DC-2 at a reported price of £10,000. It will be used on services between Nice and Corsica. It was previously owned by Swissair, the South African charter company Phoenix, and by Britavia.

Recently published by the Boeing Airplane Company transport aviation market research and planning staff is *Air Transport Fleets of the World*, a summary listing aircraft now in use and on order by all transport carriers.

Up to April 23, when the Westland Heliport at Battersea, London, had been in operation for a full year, the total number of movements recorded was 1,961. Total passenger movements were 2,385, and approximately 12,000lb of freight was handled. The busiest day was Wednesday, April 20, when there were 42 helicopter movements. The busiest month was July 1959 with 356 movements, of which 138 were related to the *Daily Mail* air race. Otherwise the busiest month was September, with 277 movements. Heaviest helicopter to be handled was the 33,000lb Westland Wessex, in June 1959. The percentage of military and Ministry-sponsored movements, 12 per cent during the first six months, rose to 34 per cent during the last six months.

. . . of Pan American jet is which?

Royal Marines of 42 Commando board a Westland Whirlwind HAS.7 of No 845 Sqn on HMS "Bulwark" during recent working-up exercises in the Mediterranean. These were watched by the Duke of Edinburgh, who is Captain-General of the Royal Marines

MEAF Chief of Staff

HAVING been Director of Operational Requirements (A) at Air Ministry since August 1958, Air Cdre T. W. Piper has from the beginning of this month become Chief of Staff to the C-in-C MEAF, with the acting rank of air vice-marshal. He is a CBE and holds the AFC, and before going to Air Ministry was on air plans duties at Transport Command headquarters.

From May 1 the position of Commander-in-chief, Middle East, has been assumed by Gen Sir Dudley Ward. He will be in overall command of the land and air forces within his area of responsibility.

SERVICE AVIATION

Air Force, Naval and Army Flying News

Accident-free Record

BOTH theology and medicine were represented at the Birmingham UAS dinner on April 26: the former by Professor the Rev G. W. H. Lampe, the vice-principal, who is leaving Birmingham this year to take up an appointment at Cambridge; and the latter by the Director-General of RAF Medical Services, Air Marshal Sir Patrick B. Lee Potter, who in his reply on behalf of the guests mentioned that the medical branch was receiving more applications for permanent commissions than ever before. He also echoed official policy when he commented that men would be always needed in the air for the defence of this country, whatever their weapons.

Sqn Ldr J. D. Cotter, the commanding officer, was able to give an encouraging report on his squadron's work: over 2,200hr had been flown in 1959, more than had ever been done in a year since 1955. Nor had there been any accidents last year; 7,000hr had been flown without one.

Sqn Ldr Cotter referred to the untimely death last year of Bernard Deakin, whose long connection with the squadron is now commemorated in the Deakin Trophy. This is awarded annually for aerobatics and was presented at the dinner, by Air Marshal Potter, to Cdt Plt J. Morton. The Priestley Cup, for the best all-round cadet, went to Cdt Plt C. Rudder.

RCAF with UNEF

AT El Arish, near the Egypt-Israel border, the RCAF carries out transport and reconnaissance operations as part of the United Nations Emergency Force. The unit concerned is No 115 ATU and its work was described in a recent issue of the RCAF magazine *The Roundel*.

Three Dakotas and four Otters are employed, painted white and bearing United Nations markings: the former do most of the transport flying, up to Beirut and down to the Gulf of Aqaba, the latter carrying out reconnaissance along the international frontier and also supplying Yugoslav outposts. The Otters also make short-range transport flights.

Under the command of Wg Cdr R. H. Manson, the unit has nine pilots, three radio officers and two navigators as its flying personnel out of a total strength of 100. It was originally called No 115 Communications Flight and when it started Middle East operations was based at Abu Suweir airfield near Ismailia.

Runway Carpeter

APPARATUS for carpeting a runway with foam, to facilitate wheels-up landing in an emergency, has been successfully devised by the general engineering flight at RAF Waddington. Consisting of a 30ft-long 12,000gal tank mounted on a 50-ton crash recovery trailer, it can lay a thick layer of foam over a distance of 1,000yd in 17min. The apparatus, which takes 15min from an unprepared start to get into position on the runway, has been demonstrated to the AOC-in-C Bomber Command, Air Marshal Sir Kenneth Cross, and to local fire officers. Fire-fighting appliances used previously for such an emergency took anything up to two hours to spread a sufficiently thick foam carpet.

In Brief

The annual UK air defence exercise, "Yeoman," is to take place from May 19 to 23.

Air Marshal Sir Kenneth Cross, AOC-in-C Bomber Command, took the controls of a Handley Page Victor B.2 during a flight from Radlett on April 29.

The 7th annual service of commemoration at the Air Forces' Memorial at Cooper's Hill, Egham, Surrey, will be held at 3.15 p.m. next Tuesday (May 10).

Marshal of the RAF Sir Dermot Boyle is to be a guest speaker at the 10th annual national convention of the RCAF Association, being held in Toronto later this month.

Sqn Off Elizabeth M. Benson is to take command of RAF Hawkinge, with the acting rank of wing officer, from May 16. She succeeds Gp Off F. B. Hill, newly appointed CO of RAF Spitalgate.

No 264 AW(F) Sqn dinner club is holding this year's reunion dinner at Beotys Restaurant, 79 St Martin's Lane, London WC2, on Friday, May 27, at 7 p.m. Further details may be obtained from Flt Lt R. C. Olding, at the RAF College, Cranwell, Sleaford, Lincs.

Flt Lt M. S. Gautry was presented with both the Cup of Honour and the D.H. Flying Trophy at the passing-out parade of No 143 Course at No 5 FTS, RAF Oakington, on Wednesday last week. Fg Off M. J. Metherell won the Aerobatic Trophy and Plt Off E. J. Ducklaw the Ground School Cup. The reviewing officer was Air Marshal Sir Wallace Kyle, AOC-in-C Technical Training Command.

Whirlwinds of the commando carrier "Bulwark" (see picture above) landing Citroen 2CVs during the assault exercises on Malta, in which 1,000 troops of Nos 40 and 42 Commandos were engaged